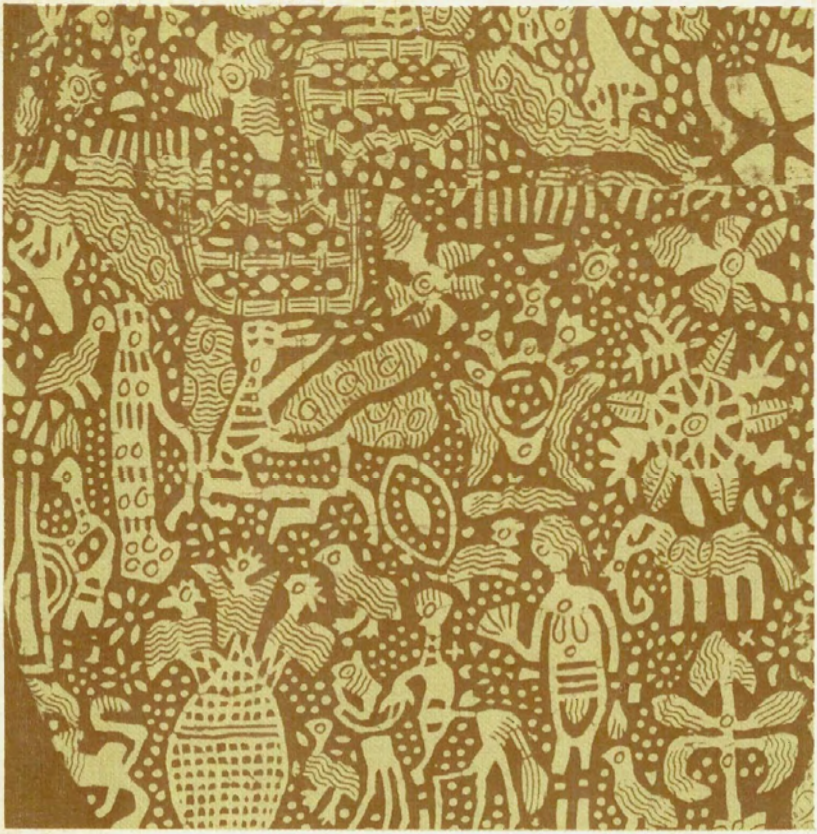

Sahelian Social Development

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Regional Economic Development
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Abidjan, Ivory Coast

SAHELIAN SOCIAL DEVELOPMENT

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FOREWORD

AID, particularly the Bureau for Africa, has pioneered social analysis of development in West Africa. As U.S. involvement in African development programs increased during the early 1960's, implememtation obstacles, resulting from inadequate understanding of social values and relations in the design and management of projects, led to introduction of social analysts as members of project design teams and as permanent staff members of missions. Professor Michael Horowitz, Department of Anthropology, State University of New York, Binghampton, was the first social anthropologist on the staff of REDSO/WA, followed by Associate Professor Dan Aronson, Department of Anthropology, McGill University, who conceived this volume. Dr. Stephen P. Reyna, Department of Sociology and Anthropology, University of New Hampshire, became his able successor.

The authors of the following papers, together with other experts cited, constitute an important segment of North America's expertise on social development of inland countries of West Africa. The papers concentrate on social aspects of historical development and on social limitations of bilateral and multilateral development projects undertaken since independence. However, they do not attempt to analyze the very significant and growing impact on Sahel societies of rapid development and change in coastal countries, especially Nigeria and Ivory Coast. The papers are a significant contribution to literature on social change in the Sahel which REDSO/WA is happy to make available to a wider audience.

Hadley E. Smith
Chief, Program Analysis
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The volume reflects the authors' view and not necessarily those of the Agency for International Development.

P R E C I S

"Un Aperçu Historique du Sahel", de Eliott P. Skinner, place d'abord la région dans une perspective d'éco-système. Ensuite, il fait la synthèse d'une énorme quantité de documents présentant une analyse de l'histoire pré-coloniale, suivie par une discussion sur les politiques de développement colonial et post-colonial. L'ouvrage présente habilement un tableau des peuplades, des lieux et des époques, orientant utilement les lecteurs sur la région.

"Les Fulani dans le Contexte du Développement: La Pertinence des Traditions Culturelles dans l'Adaptation au Changement et à la Crise" (Paul Riesman). Ceux qui sont familiers avec le secteur bétail en Afrique de l'Ouest savent que tôt ou tard ils trouveront les Fulani sur leur route ; ces superbes bergers éparpillés depuis les côtes de l'Atlantique jusqu'au Soudan. La contribution de Paul Riesman à ce volume reflète une observation attentive de ce peuple. Tout d'abord, il pose la question (et y répond): Qui sont les Fulani ? Il décrit ensuite le mode de vie économique et social des Fulani nomades et non-nomades. Son analyse montre comment le rôle des femmes et des chefs religieux sont des forces du développement pastoral qui, si elles sont ignorées, risquent de mettre en péril le succès des programmes. Ses observations économiques avancent que la plupart des Fulani (moins 11%) sont des fermiers mixtes et qu'en

choisissant d'être à la fois fermiers et bergers, ils poursuivent une stratégie "parapluie" efficace. La troisième partie de son rapport analyse des projets spécifiques relatifs à des études de puits, de gestion de pacages, de coopératives, des projets vétérinaires, sanitaires qui ont été tentés parmi les Fulani. La dernière partie avance quelques suggestions concernant les politiques de développement rural.

Riesman fait certaines recommandations. Celle qui suggère la création de banques nationales de bétail offre un certain intérêt pour d'éventuels nouveaux projets. Ces banques..."dans lesquelles le propriétaire mettrait en gage un animal et recevrait un certificat pouvant être échangé à tout moment contre un animal équivalent. Ceci permettrait de débarrasser le pacage d'animaux indésirables (ceux-ci pourraient ensuite être engraissés) et donnerait au propriétaire l'assurance de possèder un animal rachetable en cas de période néfaste. Cette suggestion mérite qu'on l'exploite car elle concerne à la fois l'investissement du berger et l'écologie des pacages.

Il recommande également que les projets bétail incluent des "faciliteurs de groupe" dont "...le travail consisterait à informer les Fulani sur ce qui se passe dans le monde et sur ce qui a rapport à leurs exploitations... J'imagine très bien le "faciliteur" demandant à l'imam local (notal religieux) de l'aider à organiser des rassemblements au cours desquels des informations et des points de vue différents pourraient être échangés. Le "faciliteur" pourrait

également exercer un rôle plus actif ; il pourrait inciter les gens à penser ou à discuter de leurs problèmes et leur proposer des solutions".

Cette proposition va au coeur du problème qui cherche à savoir comment les professionnels du développement peuvent justifier un changement: en attirant l'attention de certains membres choisis de la population sur ce que coûtent ou rapportent réellement les différents volets du développement.

"Les Conditions d'une Intensification Agricole en Zone de Savane dans l'Ouest Africain". Robert McNetting et ses collègues, David Cleveland et Frances Stier, discutent des conditions permettant d'intensifier la culture dans la savane de l'Afrique de l'Ouest. Leur effort se répartit en quatre chapitres. Le premier définit l'intensification tandis que le second présente six explications (relatives à la culture, l'environnement, la technologie, la démographie, l'économie et la politique) permettant de justifier le changement de politique agricole. Le troisième examine et explique des exemples d'intensification dans la région Nord-Est du Ghana, le Nord du Nigéria et à l'intérieur du delta du Niger au Mali. Le dernier chapitre analyse les perspectives d'avenir favorisant l'intensification. Netting et ses collègues font les observations suivantes: (1) les prédispositions culturelles... peuvent affecter le degré et les orientations des changements en matière d'agriculture, mais elles ne forment pas une coquille imperméable à toute innovation, (2) Il n'y a pas de simple

corrélation entre l'habitat et les systèmes agricoles, mais les politiques de production alimentaire semblent réglées de façon à minimiser les risques introduits par des facteurs dûs à l'environnement ou à d'autres variables ; (3) Une forte densité démographique est souvent citée avec des exemples d'intensification agricole, mais l'intensification n'est pas obligatoirement destinée à accroître les disponibilités alimentaires par tête d'habitant ; (4) Les innovations technologiques permettant d'accroître la production alimentaire seront mieux adaptés si elles sont "additives" et répondent à un véritable besoin dans les systèmes agricoles existant ; (5) De nombreuses politiques adoptées par les gouvernements nationaux ou les agences de développement, surtout celles qui sont liées à la commercialisation de la production, ont pour effet d'accroître les risques courus par les fermiers. Les contraintes et les risques du marché sont reconnus comme les principaux facteurs économiques de ralentissement de l'intensification agricole. On dénonce également l'insuffisance des infrastructures de transport qui réduit l'accès au marché.

Netting et ses collègues concluent qu' "Etant donné un environnement local où les conditions de sol, d'eau et de santé permettraient une utilisation plus intensive de la terre, les progrès s'effectueront plus rapidement là où les considérations économiques à l'égard des exploitations agricoles sont les plus évidentes. Nous défendons un point de vue écologique qui inclut les variables politiques, économiques, démographiques, technologiques et géographiques qui affectent

directement le mode de décision du petit propriétaire et qui ne peuvent, dans la plupart des cas, être démêlées qu'après une observation sur le terrain".

"Les Projets d'Intensification Agricole dans le Sahel Patronnés par le Gouvernement. Le Développement, pour qui?". La contribution d'Abe Waldstein à ce volume consiste en un examen détaillé des conséquences socio-économiques des projets d'irrigation allant du Sénégal au Soudan. Elle comprend sept parties. Les trois premières examinent les principaux projets d'irrigation, et en particulier leurs buts; la quatrième s'attache tout particulièrement à l'organisation et à l'administration des divers projets. La cinquième note qu'il y a eu des divergences d'intérêt entre les contrôleurs des projets d'irrigation et les fermiers, et examine ce que ces divergences ont signifié pour les fermiers. Les deux dernières parties présentent ses recommandations. Il observe que la plupart des projets d'irrigation partagent trois qualités: ils sont à fort coefficient de capitaux, à grande échelle et administrés par des agences para-gouvernementales centralisées. Ses conclusions sur de tels projets sont troublantes du point de vue du mandat "Nouvelles Directives" car l'évidence des faits suggère: (a) que les principaux bénéficiaires des projets ne sont pas toujours les pauvres des régions rurales; (b) que certains projets diminuent le contrôle que les pauvres ont sur leur mode de vie, les réduisant au rang d'employés manipulés par des agro-industries

autocratiques; (d) que certains projets ont encouragés l'injustice en créant une nouvelle sous-classe--celle des métayers ou des manoeuvres salariés; (e) que certains projets ont tenté d'aliéner le principal facteur de production du pauvre des régions rurales: la terre; (f) que certains projets ont été directement à l'encontre de l'intérêt des femmes.

Waldstein recommande qu'un nombre plus important de projets d'irrigation soient administrés par les fermiers, là où: (1) la propriété de la terre est sous le contrôle d'une coopérative basée au village; (2) les infrastructures sont construites par les travailleurs locaux et non pas par une main-d'oeuvre mécanisée; (3) les villageois qui choisissent de participer aux activités des coopératives reçoivent une portion du périmètre proportionnelle à la grandeur de la famille; (4) les participants sont libres d'incorporer comme ils l'entendent l'usage du périmètre à leur budget d'entretien--ils vendent la récolte qu'ils ont choisi de cultiver là où ils veulent et dans les proportions qu'ils désirent; (5) l'entretien des infrastructures est la responsabilité des coopératives.

"Coopératives, Initiatives, Participation et Changement Socio-économique au Sahel" (Bill Derman). Ce qui est essentiel pour la bonne réalisation des programmes de développement sahélien c'est la création d'institutions qui encouragent l'initiative individuelle et la participation du groupe local. Dans sa contribution à ce volume, Bill Derman examine la documentation concernant ces problèmes.

Son travail est divisé en quatre parties. La première met en contraste les différentes théories de développement dans le cadre du changement sahélien. La seconde examine les coopératives et les programmes de vulgarisation depuis l'ère coloniale jusqu'à nos jours, évaluant en particulier, leur effet au Sénégal, Mali et Niger. La troisième, examine les conditions qui encouragent et découragent l'initiative indigène, alors que la dernière partie détaille les tensions et les contraintes qui résultent des objectifs divergents des gouvernements nationaux et de leurs citoyens ruraux. Il justifie son opinion que les organismes de développement et les gouvernements sahéliens ont poursuivi des politiques visant à commercialiser la production paysanne en employant des moyens qui trop fréquemment profanent les intérêts des fermiers. Les coopératives et les programmes de vulgarisation ont été des instruments favoris pour obliger les paysans à adopter des lignes de conduite qui bénéficient aux élites locales et nationales. Les initiatives locales sont étouffées car les paysans considèrent le personnel des coopératives et des programmes de vulgarisation comme des agents hostiles agissant contre l'intérêt propre des paysans.

I. INTRODUCTION

Stephen P. Reyna

In 1978, USAID's Regional Economic Development Services Office of West Africa (REDSO/WA) proposed a series of papers on social development in the Sahel. Five scholars of Sahelian social change with international reputations were invited to discuss development issues. Each concentrated his observations on the farming and livestock sector characteristic of social development in the Sahel, and considers issues such as: (1) factors facilitating social acceptance of innovation; (2) roles of local initiative and participation in change; (3) contributions of local, national and international institutions to development; (4) effects of parastatal agencies on local economies; (5) the impact of development interventions on women's welfare. The resulting set of papers probably is one of the more complete analyses of the conditions and consequences of Sahelian social development. AID's objective in publishing these papers is to facilitate West African development by bringing their insights to a wide audience of development practitioners.

Why think about Sahelian social development? Societies are composed of interacting economic, political, and cultural parts formed with specific histories in differing habitats. In this sense, social, refers to any aspect of people in groups--ranging from families to international organizations. Such a view stresses that the different social components are interrelated so that events in one part have repercussions in other parts. Social analysis consists in demonstrating how the parts are interrelated--in discovering, for example, how over time certain political happenings have economic or cultural results, or vice versa. It is in this sense that the five authors use the term social, i.e., seeing how different parts fit together, noting the forces acting upon them, and trying to arrive at a coherent picture of Sahelian development.

Eliott P. Skinner's "A Brief History of the Sahel" synthesizes a large quantity of literature analyzing pre-colonial history, followed by discussion of colonial and post-colonial development. The story he tells is that the Sahel--always a periphery--has exchanged one metropole (the circum-Mediterranean region) for another (Western Europe) in the past 200 years as its part in the global industrial growth process dominating contemporary

development. From the vantage of the Sahelian village, this process has meant loss of autonomy and increase in dependency as a variety of national and international institutions have penetrated local communities.

A stereotype of Sahelian pastoralists is of individuals so deeply afflicted by animal infatuation that they wander about an inhospitable bush singing songs and dedicating poetry to their beasts, when they should be doing the rational thing and selling them at the local abattoir. Paul Riesman's "The Fulani in Development Context: The Relevance of Cultural Traditions for Coping with Change and Crisis" deals a strong blow to such characterizations. Taking certain aspects of pastoral life formerly considered questionable, he explains how they follow from the nature of herding economies under the constraints of pastoral conditions. For example, he reminds us that herd movements are dictated by climatic regimes which result in localities with insufficient grasses and water for herd survival throughout the entire year. Put bluntly, if herders didn't move, their animals would die; if their animals died, they would tend to die; all of which tends to whet the herder's appetite for mobility.

Herders are alleged by many Sahelian livestock specialists to have never had means to regulate access to

own market oriented ends.[1/]

To many observers, the Sahelian farmer has seemed even less responsible than the herder. Hobbled by such anatomical syndromes as the backward bending supply curve, their most characteristic trait has been thought to be limited wants, which was interpreted as laziness. Robert McNetting, David Cleveland, and Frances Stier's "The Conditions of Agricultural Intensification in the West African Savannah" seeks a better understanding of farmers. Their approach is to identify conditions intensifying dryland farming by examining--in three known areas of intensification (northeastern Ghana, northern Nigeria, and the Malian interior Niger delta)--the roles of six factors (cultural, environmental, technical, demographic, economic, and governmental policy) believed capable of stimulating productivity increases.

1/ Riesman suggests that the assistance of religious practitioners (marabouts) be solicited for development scheme involving the Fulani. The reasoning supporting this recommendation is both an excellent example of social analysis and illustration of how deeply forces emanating from Western expansion have influenced pastoral society. For Fulani, the colonial epoch resulted in loss of political autonomy and slaves. These losses, he asserts, intensified a sense of helplessness, which in turn heightened beliefs that only God can assist human affairs. Such beliefs strengthened the authority of religious practitioners for these specialists in Divinity are able to support people in their relations with God--hence the rationale for the alliance between development bureaucrat and marabout.

McC. Netting, Cleveland and Stier suggest that cultural or traditional beliefs may affect change rate, and direction, but that they do not form a rigid barrier to productivity-increasing innovations. The impression one receives, which is important enough for systematic exploration, is that traditions are part of a feedback system involving economic opportunities. As opportunities change, traditions alter to take advantage of these opportunities, which increases reliance on the opportunities; with reinforcing effects on the altered traditions The authors report an absence of any simple relationship between environment and farming systems, although they observe that existing food-production strategies seem designed to minimize risks introduced by environmental uncertainties.

We are told that government policies, economic changes, and technological innovation all possess productivity-stimulating qualities. But Netting et. al. imply that existing policies have had the opposite effect because they tend to increase farmers' risks. They report that economic factors such as farm-gate prices and market accessibility have tended to depress production, and that, where intensification has occured, it has often been in the absence of technological innovation. On the

other hand, intensification is often associated with high population density. Thus, in the absence of appropriate policies, market conditions, or technology, Sahelian farmers have intensified because greater population size results in land scarcity and eventual declines in soil fertility. Productivity increases under such conditions do not increase welfare because the greater output is consumed by the additional population.

The picture Netting et al., detail is really one of neglect in dryland agriculture. Colonial policies generally ignored food-production. Rather they were devoted to cash-crops, principally cotton and peanuts, of interest to European industry. Such policies were largely continued by the independent Sahelian states until the drought of the early 1970's. The result is that existing dryland food-production systems remain largely intact, though the environment necessary for their survival is changing. Human population is rapidly growing. Previously adaptive components of farming systems, eventually, under such conditions, become destructive of soil fertility. Thus, Sahelian dryland agriculture can be characterized as exhibiting, under low population density conditions--low output, productivity, and per capita consumption levels; or under high population density, conditions of--slightly higher output and productivity

pasture. Consequently, under the pressure of constantly increasing animal numbers, each herder in a sort of tragedy-of-the-commons, unrestricted by tenure constraint places his animals in pasture regardless of the number of animals using it, thereby contributing to pastoral ecosystem degradation. Reisman challenges this view. Michael Horowitz and his group at the Institute for Development Anthropology have fully explored the development significance of Reisman's and similar data of other ethnographers 1/ They suggestthat herd growth is the result of animal health services provided by colonial and post-colonial governments to stimulate meat productio for the market and that many pastoral populations did have indigenous mechanisms for regulating stocking rates, but that these were destroyed when herding societies lost the ability to make political decisions consequent upon their incorporation into colonial administrations. Destr tion of pastoral ecosystems, if it is occuring (Horowitz shows the empirical evidence to be inconclusive), would appear to result from events imposed upon herders by outsiders bent on exploiting the herder ecotype for their

1/ See especially Michael M. Horowitz: "The Sociology of Pastoralian and African Livestock Projects". AID Contract: AID/otr-147-78-48. May 79.

BEST AVAILABLE

to maintain previous per capita consumption levels. Such a situation is one of growth withour development.

If matters appear disappointing in dryland agriculture, far greater optimism has seemed permissible in irrigation. Here the idea is to exploit the Sahel's riverbasins with large-scale, capital intensive, parastatally managed irrigation systems. Such enterprises resolve two fundamental problems in Sahelian development--low productivity and increasing food imports. The strategy seems to be that if high productivity 'Gardens of Eden' are created along the rivers that interior bush problems will disappear.

Waldstein evaluates the impact of these 'Gardens of Eden'. Following review of published and unpublished sources concerning irrigation schemes from Senegal to Sudan he concludes that: the major beneficiaries of the schemes are frequently not the rural poor; certain schemes have threatened achievement of target population material security; some projects have tended to alienate the rural poor from their major productive asset--the land; and at least some of the schemes have been contrary to the interest of women. Perhaps the most significant conclusion is that most schemes have not worked well either as economic enterprises or to improve farmer welfare.

Waldstein's explanation of why this is the case involves consideration of the relationships between costs of irrigation schemes, the international financial community, the structure of production, and their impacts on peasant economy. Capital intensive irrigation is very expensive in the Sahel, between $5,000 to $12,000 per hectare for initial investment in the late 1970's. Initial capital costs are enormous, involving construction of major infrastructure and purchase of machinery. Variable costs are high and escalating because of irrigation's dependence on petroleum byproducts. Such cost-magnitudes, in a society lacking experience in irrigation, involve considerable investment risk. International financial institutions thus, understandably, tend to impose conditions to reduce these risks. Such conditions structure the organization and rewards of production.

Consider first the organization of production. If a development bank has invested $10,000 in a hectare, and the farmer has never done irrigation agriculture before, the bank is little inclined to allow that farmer to cultivate as he wishes. Hence, the farmer's autonomy as an agricultural production unit is abrogated. He is normally placed in a cooperative. But this cooperative is not an independent, farmer-controlled and managed institution. It is, rather, the lowest organizational level

in a parastatal agro-industry. The farmer cooperative resembles a corporate workplace, and the peasant has no greater autonomy of decision than his industrial counterpart. What is produced, how, when and where, are management decisions. Further, farmer rewards tend to be as low as possible because returns to labor are the only costs over which the parastatals have any real control. Hence, farmers often find themselves facing low farmgate prices when they sell their produce to the company, as they generally must, and high charges for inputs. For many farmers participation in irrigation agriculture requires debt.

Finally, managers of irrigation schemes tend to be inexperienced in Sahelian conditions resulting in unreliability of water supply; neglect of ditches, ground levelling, and field maintenance; and inappropriate plant husbandry. Problems induced by centralization of inexperienced managerial control precipitate labor problems. The result is that irrigation agriculture has led to uncertain gains in productivity, often at enormous costs. In "Development For Whom?", Waldstein seems to be saying that thus far, large-scale, capital-intensive irrigation has fallen far below expectations.

Bill Derman's "Cooperatives, Initiative, Participation, and Socio-Economic Change in the Sahel" discusses the institutions most responsible for implementing development. Emphasis is on the market, cooperatives, and parastatals in Mali, Senegal, and Niger.

External domination during the colonial period meant policies designed to coerce utilization of the market. Forced labor, cultivation of cash crops, delivery of products, and taxation created a demand for and a supply of money among Sahelian peasants. Derman cites studies suggesting that the impact of these policies frequently has been economically and socially negative. Indeed, farmers may have been able to secure money supplies, but often the amount they acquired was so small, in terms of the cash requirements these policies generated, that peasants welfare stagnated. At the same time stresses induced by the need to acquire cash weakened and in some cases destroyed indigenous marital, familial, and descent institutions.

Cooperatives and parastatals are institutions favored by contemporary Sahelian nations to regulate dryland irrigation, and pastoral agriculture, the former to structure the entire production process, the latter to control the labor component in the process. Derman's judgment

concerning cooperatives is that they have been unsuccesful. A main reason appears to be that cooperatives function to enable the state to appropriate a large percentage of the revenue farmers derive from commercial activities. His analysis of parastatals, while less extensive, implies similar conclusions. During the colonial period, peasant surpluses were extracted ultimately by compulsion. In the post-colonial era, cooperatives and parastatals do the same job behind a rhetoric of nationalism and socialism.

Common to all institutions charged with responsibility in agriculture has been the structure of power. Whether it be during colonial or post-colonial periods, in market relations, cooperatives or parastatals, power has not been with the producers, but with external forces such as colonial and nation-state bureaucrats and politicians. Such a structuring of power makes it difficult for agricultural producers to defend their interests.

In summary, the authors imply that an aim of colonial agricultural policy was to push Sahelians into a market economy by forcing farmers to produce crops required in the nations of the industrial North Atlantic. Institutions were developed that obliged farmers to produce crops used in industrial Europe; that forced them to sell these crops

at low prices; and which induced them to purchase cheap, consumer goods. Such policies, using new cooperative and parastatal institutions, were largely continued in the post-colonial period, at least until the 1970's drought. Emphasis under such policies is not on increasing productivity and productive capacity, but in capturing as much as possible of the farmer's wealth by buying his output cheaply and selling him consumer goods dearly. From the perspective of Sahelians, this situation is existential. Choices are made in negative utility fields among lesser evils. Today in the Sahel one can raise animals or plants and be very poor; or one can leave.

Emergent in these papers is a strategy for Sahelian development. Desired interventions are those which increase agricultural productivity and capacity. Target populations will be encouraged to change if they are provided information comparing real costs and benefits of present and innovative means of satisfying economic problems. Indigenous local institutions with real powers and authorities are most likely to stimulate participation in the implementation of changes,

II. A BRIEF HISTORY OF THE SAHEL

Elliott P. Skinner

Elliott P. Skinner, dean of American anthropologists working in the Sahel, is Professor of Anthropology at Columbia University and a former United States Ambassador to Upper Volta. He is the author of numerous books and articles concerning West Africa.

The Sahel, like other regions of the world, has an ecosystem--defined here as a dynamic interrelationship between the human societal subsystem, the plant and animal (biota) subsystem, and the natural environment subsystem. Under normal or ordinary circumstances, an ecosystem adapts or adjusts to small changes or perturbations within its component parts or subsystems; however, if subsystems change, the nature of their linkages or relationships to each other within the total ecosystem are modified. For example, if the population of a society in an ecosystem increases, the changes in the other subsystems may involve a greater use of the biota for food, and/or a wider distribution of the population over the landscape. More severe changes within any subsystem may generate not only modifications in the

linkages between subsystems, but also total changes within the other subsystems. If there is a drought or famine in a certain ecosystem, its human population may migrate to other areas, or develop social and ideological mechanisms to compensate for scarce food resources and may generally rectify the imbalance in order to ensure that the ecosystem has a chance of survival. In other words, ecosystems tend to exhibit an equilibrium of sorts, but one that does not prevent the total ecosystem from changing over time.

Ecosystems can break down or be destroyed if they cannot adapt, or are not permitted to adapt to radical changes in their subsystems, or within the wider overall network of ecosystems. Military conquest, accompanied by the seizure of the territory of an ecosystem by people of another ecosystem, the appropriation of its food resources, and the subjugation or destruction of its population, often causes the disappearance or the destruction of an ecosystem. If the conquerors do not appropriate the land of their victims, seize all of their food resources, or destroy all of their people, the ecosystem may recover, but it is doubtful whether it would return to its previous form. This would be especially difficult if the conquerors were able to condition the way in which the reviving ecosystem related to the larger ecosystem network.

Natural disasters and pestilences can also cause the breakdown or destruction of ecosystems. Thus, the destruction of a society's habitat either by the forces of nature, human beings, animals or plants could cause ecosystem failure. This could happen especially if the population were unable to leave the threatened area, or, if for ideological reasons, they were adverse to migrating from an area which was doomed. The spread of virulent diseases among an ecosystem's biota, either among plants, animals or human beings could cause the destruction of the system, that is, if the biota does not leave its environment or find other mechanisms to deal with the diseases. If people leave environments threatened by the forces of nature, man or animals, or vacate areas threatened by pestilence or find means for combating the diseases, their ecosystems might persist. But again, the surviving ecosystem would be different from the former one, and, because of its experience, might be integrated into an ecosystem network in a novel way.

Natural and social disasters often reveal (that is, if the ecosystem is not immediately destroyed) the interconnections of various components of an ecosystem and which components are most viable or most vulnerable. Hopefully, natural, social disasters also illuminate how the ecosystem

could be changed if it is to survive. For example, it is well known that societies are the most complex subsystems since they possess social groups organized in different ways which hold different values. Under normal conditions the links between these different social groups are either congruent with or do not jeopardize the links between the societal subsystem and the other subsystems. However, when the entire ecosystem is in danger, the links within the social groups in the societal subsystems become tenuous. For example, conflict between social groups may lead to using the habitat or food resources in ways detrimental to the survival of the entire ecosystem. In such a case, the issue might be resolved by changing the links or relationship between the social groups of the societal subsystem.

Similarly, if the examination of an ecosystem under pressure shows that the habitat is being destroyed by the increase of wild species of animals or plants, the condition may be corrected by man's intervention to halt the increase of the other biota, or to change the relationship between them and the habitat. Finally, it might be necessary for human beings, the most active entities in an ecosystem, to modify the links between an ecosystem and its ecosystem network if either a subsystem is to maintain its viability or the ecosystem is to survive.

The Sahel ecosystem of West Africa is experiencing such great difficulty, that some say that it has reached a point of imminent breakdown. In order to understand why this is so, and what if anything can be done about it, it is imperative to identify the factors that have led to this condition.

The Sahel's environmental subsystem is fragile. Most of this 200,000 square mile area is a plateau some 500 to 1000 feet above sea-level, lying between 12 and 20 degrees north latitude and between 25 east and 18 west longtitude. The temperature in this area ranges from 69 degrees Farenheit in January to about 90 degrees Farenheit in May. The Sahel receives 5 to 30 inches of rainfall per year, but the rain even in the 30 inch zone is concentrated in three to five months. It is therefore, not as useful as it would be if it were spread over many more months of the year. Some of the rain water finds its way to a water table of variable depth while that which is not lost to evaporation, flows into the rivers and water systems of the area. These include the Niger river, the Senegal river, the Volta rivers, and the Lake Chad system. As none of these water sources were developed as irrigation systems, they did not make a contribution to the local economies. The area's vegetation consists primarily of grasses, orchard bush and thorn plants. However, as one approaches the Sahara, all

vegetation disappears. The Sahelian soils are potentially rich, but the primarily chestnut and light soils of the area are often lateritic and generally poor.(1)

The history of the Sahel ecosystem is responsible for many of the contemporary biological, physical and socio-cultural challenges. Moreover, it is necessary to point out that this ecosystem has frequently been affected by the actions of nature and man. For example, during the Pluvial and Arid periods of early Sahelian history, the region's vegetation frequently changed from lush tropical forests to sterile deserts with a corresponding change in the animal and plant populations. The last major change took place while humans (then hunters, fishers and gatherers) inhabited the region: lithic kits along the now sandy valleys and bone-dry wadis are evidence of an ecosystem that no longer exists. As the Sahara dried up and humans moved south, hunting and gathering as the basic food producing activities in the region changed. The people in the Niger River Bend faced the problem of adapting to an environment that was becoming increasingly dry. They abandoned hunting and gathering, ennobled the indigenous millets and sorghums which became the basis of their agriculture, and acquired cattle and other livestock from the east which became the basis for their way of life.(2)

By 300 A.D., the ecosystem of the Western Sahel had become quite complex. The proto-Tuareg populations had already developed camel pastoralism and freebooting as a way of life in the northernmost part of the area. Further south, the pastoralists with their cattle moved in transhumance cycles between the edge of the forest zone and the Sahara, often attempting to invade ecological niches occupied by more numerous agricultural peoples. The latter, more sedentary, with a more productive economic base, were able to elaborate more complex socio-cultural systems. Some developed state structures and used their military organization to incorporate weaker agricultural peoples, and to structure relations with the mobile pastoralists and fishing populations in the Niger River complex. The development of trade and commerce within the Western Sahel not only linked the various societies, but enabled the people of the region to establish trading relations with the Mediterranean region, with Egypt, and with the peoples of the forest zone.

The medieval kingdom of Ghana, located in the present-day Republic of Mauritania, used its position between the Mediterranean and the forest zone to generate trade in gold, ivory, salt, slaves, and other luxury items. It also used its power to attack the salt-producing desert area and

the neighboring savannas and forest zones. Ghana attracted merchants and goods from the north and south and acted as a conduit for ideas flowing in both directions. But the most important aspect of early Ghanaian society was its ability to interact with people from other ecosystems while retaining its own viability. Thus, when Islamicized traders began to arrive in Ghana's capital from the eighth century onward, the Ghanaians incorporated them by permitting them to live in their own stranger quarters, and to follow their own religion.(3)

The early Ghanaians encountered difficulties when they attempted to expand their state system at the expense of their neighbors. The result was that the Berbers, using Islam as a revivalistic doctrine, revolted (1054), and incorporated the salt-producing territories of the Sanhaja. In 1076 under Abu Bakr, the Berbers conquered Ghana and occupied Kumbi, its capital. Ibn Khaldoun, writing a few centuries later, tells what happens to the people of an ecosystem when they were conquered: "The Kingdom of Ghana declined into utter weakness about the time that the empire of the Almoravids began to become powerful. The Almoravids extended their dominion over the Negroes, devastated their territory and pillaged their lands. Having subjected them to the gizya (poll-tax on non-Muslims), they exacted tribute from them and induced many of them to become converts

to Islam. (The authority of) the kings of Ghana was destroyed, and (their southern neighbors) subjugated the country and reduced its inhabitants to slavery."[4] Ghana did expel the invaders but the effect of the Almoravid conquest persisted. We are told that "Their plundering and, even more, perhaps, the demands made by their herds on the available grazing, had upset the delicate balance between man and nature on which agriculture depended in a region so close to the desert. Wells were neglected; the soil's essential cover of vegetation was denuded. The desert began to spread southwards until ultimately the lands in which Kumbi, the old capital, was situated could support neither towns nor, indeed, any sizeable number of people." [5] Finally, in 1200, Sumanguru, King of the Susu, a people formerly ruled by Ghana, conquered Ghana and made it tributary to the rising kingdom of Mali.

The Mali empire developed near the junction of the Sankarani and Niger rivers (probably at Niani) in a fertile agricultural area, not too far from the alluvial gold deposits in Wangara. Using Islam, with its universalistic codes and creeds as an operational weapon, the kings of Mali incorporated more diverse populations into their state system than did the Ghanaians. By the 1300's, they had extended their rule through Senegal and Gambia to the Atlantic, and eastward beyond Timbuktu to Gao (a Songhai

town) and southward into the Volta area. Under Mansa Musa (c. 1325), agriculture was highly developed, trade was extensive, literacy in Arabic increased, and Islamic scholars, many of whom had made the pilgrimage to Mecca (hadj), provided an integrative ideological superstructure for the society.

Nevertheless, the time came when the Malians could no longer utilize Islam as a mechanism to keep their empire unified. Al-Omari indicates that, by the end of the fourteenth century, the Mansas started to refrain from imposing Islam on their tributaries. They thought that by doing so they "might lose the traditional allegiance of the pagan gold-miners and farmers on whom the empire was dependent for its wealth. By the beginning of the fifteenth century, the central power was clearly weak and the empire was collapsing. The western provinces along the Senegal valley were lost; the Tuareg regained control of Walata and other desert towns, and even took Timbuktu; Mossi cavaliers began to raid from the south deep into the heart of the empire."(6) Mali began to give way to Songhai.

Like other Sudanese before them, the Songhai of Gao were to liberate themselves from their Malian conquerors and, in turn, to subdue their conquerors. Sonni Ali, a Songhai king, invaded Malian territories; established a commercial network based on three towns - Gao, Timbuktu and Jenne;

built canals and improved agriculture in his realm. Islam was not used as a unifying ideology. Sonni Ali ruled by the power of his army, and it was from the ranks of the army that Askia Muhammad arose to usurp the throne from Ali's son. Askia, a devout Muslim who had made the hadj, restored the might of the Muslim bureaucracy destroyed by Ali, and launched jihads, or holy wars, against the Mossi in the Volta area, conquered parts of Hausa country, and drove the Tuareg into the desert. These actions so alienated the Songhai and the other tributary groups in the empire that the very power of the Askia weakened.

The Songhai empire began to crumble when an expanding Western European commercial system began to exploit gold from the forest region that formerly came north to the Sudan for shipment to the Mediterranean. The early European traders along the west coast of Arica were so excited about this gold that the English, using gold that allegedly came from Jenne, minted their 21 shilling piece and called it the Guinea. In 1590-1591, the king of Morocco, anxious about the shortage of gold and wishing to seize the Malian-controlled salt mines in the Sahara, struck Timbuktu, the very center of power and trade of the Songhai empire. The result was disaster for the rather complex ecosystem that was the Western Sudan. We are told that "trade ceased to

flow into Jenne, Timbuktu and Gao in the old way, and the trans-Saharan trade from the latter two, which might have reached Morocco, began to decay. Worse than this, the structures and habits of orderly government, which had been increasingly spread over the whole western Sudan from Ghana, Mali and Gao in turn, and which were so essential for the production and passage of trade goods, both within the Sudan itself, and to feed the more westerly trans-Saharan trade, were now broken up."(7)

With Songhai's decline, the stage was set for the development of marginal and smaller state systems in this region. The Bambara, under Biton Couloubali, established a non-Islamic and primarily agricultural-based kingdom at Segu. The Manding traders dispersed and organized themselves as travelling merchants. The Tauregs periodically left their desert fastness to sack the riverain towns including Timbuktu, where they ended Moroccan-Arma rule. The Mossi people retreated to the Volta region and consolidated their state structure, and the Fulani (now freed from overall political control) migrated eastward, exploiting all available niches with their cattle. Most important of all, the westernmost areas of the Sahel entered the Atlantic slave trading complex. The Europeans needed African manpower for their emerging plantation colonies in the New World.

Although in contact with Europeans since 1441 and participating in the Slave trade and other types of commerce since the end of the fifteenth century, the Sahelians were not the subject of sustained European contact until the middle of the seventeenth century. In 1659 the French established a trading post at N'Dar which they rechristened Saint Louis, and fought both the Dutch and the British for control of the important slave-trading port at Goree. From this region they drew innumerable slaves whose labor, while enabling Europe's ascent to industrial might, was obtained at the expense of Sahelian societies, which suffered from declining population and internecine warfare. The increased trade drew the Sahel into an emerging network of European colonial ecosystems, but only as a peripheral provider of manpower, as a supplier of raw materials for export, and a consumer of alcoholic beverages, and manufactured trinkets.

But even this early and tenuous relationship between Europe and the Sahel was to have severe repercussions within the local ecosystem. Fulani nomads, who had been the tributaries of many of the agriculturally-based kingdoms, found themselves being increasingly taxed by kings whose revenues were reduced by the loss of manpower occasioned by the slave trade. The Fulani resented these

exactions, and using their newly embraced religion Islam as a mobilization weapon, launched a series of holy wars throughout the region. They created theocratic states in Fouta-Djalon in 1725, and in Fouta-Toro and Bondou in 1776. By 1810 they defeated the Bambara, founded a theoratic state in Macina, and reduced Segu to tributary status. These conquests not only changed the economic, social, political and religious institutions in the area, but were to nave a profound effect on the natural environment. Fulani herdsmen had greater freedom and facility to compete with the agricultural populations for the same natural areas. And while their cattle were not as destructive as sheep in other world areas, the total eco-system changed.

As the internal and external impact of Europeans in the Region increased, some African leaders attempted to use Islam to create new and viable societies. One such person was El Hadj Omar, a Toucouleur from Fouta-Toro who went to Mecca (the classic prophetic withdrawal) and returned with a new doctrine and sect, the Tidjaniya. His rather democratic teachings won him converts among ex-slaves, women, young men and others oppressed by the local feudal systems. As the movement began to develop political and military aspects, it attracted a diverse

and burgeoning following of able and ambitious men, whom Omar armed with weapons obtained from trade at the coast. In 1850, he launched a jihad, conquered Bambuk and Boure, Kaarta, Segu, and finally Macina. However, he could make no headway in Senegal since he was opposed by the local rulers currently being subjected to direct French rule. Defeated by French arms in 1859, Omar signed a peace treaty with General Faidherbe in 1860 renouncing any attempt to conquer Senegal. Omar turned towards the organization of his empire only to be killed during a Fulani revolt.

By 1800 it was clear that the French were prepared to incorporate the whole Sahelian area into their imperial system. The slave trade had ended in 1815 and the Europeans sought other uses of the area in addition to a plentiful source of gum arabic, ostrich plumes, and spices. Travellers such as Houghton, Mongo Park and Rêne Caillie had already penetrated the region to discover something of its potential. In 1817, Colonel Schmaltz had received permission from the Lebou leader, Moctar Diop to introduce some two hundred European emigrants from the Société Colonial Philanthropique. This small group was soon liquidated by the climate. In 1819, the French succeeded in obtaining a concession of land on which they developed a model farm, La Sénégalais. Richard Toll,

an agronomist who conducted the first experiments in African tropical agriculture, was a part of this venture. The result was to be familiar: "Little by little, the unforeseen difficulties led to its [the farm's] total abandonment."(8) Nevertheless, the French retained the area and sought in vain for more concessions.

While the French could initially do little with the agricultural potential of Senegal, the local people had successfully integrated an American-derived crop, the peanut, into their economy, and were producing it in potentially exportable quantities. In 1840, Jaubert, seeking some way to exploit the crops growing in the region sent some 722 kilograms of peanuts to Marseille as a test. Richard-Molard records that "success was immediate; it was necessary to send machines, to introduce railroads and later to send steam vessels. From the time of the July Monarchy, the Saint Simonians were active. Once their man was in power, the era of hesitation ceased. Napoleon the Third proceeded with the occupation [of Senegal] and imperialistic colonization became an economic necessity."(9)

It was the growing French economic interest in Senegal as well as their plans to increase their influence in the region that led them to protect Senegal from the empire-building process of el Hadj Omar and to conquer the entire

area themselves. After defeating Omar, Captain Faidherbe, (ultimately General), established French control over the Moors in Maurentania, conquered Fouta-Toro and Fouta-Djalon, and elaborated a policy of "Peace or Powder" which laid the basis for later colonization of the entire region. By 1864, when he left West Africa, Faidherbe had encouraged Christian missionaries to proselytize the people. In addition, he had created schools and administrative posts; established the port of Dakar and "had founded the future of Senegal on peanuts which already, each year, it was sending several thousand tons to Marseille and Bordeaux."(10)

France's push to conquer the entire area was halted by her defeat by Germany in 1870. However, as soon as that war was over and the Republicans had assumed power in France, the drive for total control was resumed. Jules Ferry led a campaign to develop an economic bastion in West Africa which would later help France take her revenge on Germany. The drive to the east began, but each step of the way was challenged by a powerful black king, either a successor or emulator of Omar. The French conquered Bambara country, occupied Timbuktu and Gao, humbled the Moors and Tuaregs, defeated the Mossi, and captured and exiled Samori who had used the Dioula merchant complex to create a powerful state. The Berlin conference sanctioned France's incorporation of the Sahel into her colonial realm.

Many economic historians have argued that the French did not gain much by conquering this area. The Sahelian ecosystem was becoming marginal to the important economic developments in West Africa. Fage states that by this time:

> "the Sudan no longer possessed the economic strength it once had as West Africa's gateway to the trade of the rest of the world. There is no evidence that the trans-Saharan trade was declining in volume or value before the last quarter of the nineteenth century. Indeed it may have reached its peak c. 1875, when one estimate puts the value of the two-way flow of goods across the Sahara at about £ 1,500,000 or $3,600,000. But this was now small compared with the trade flowing to and from West Africa by sea. Already a single port like Lagos could be dealing with almost as much trade as all the trans-Saharan routes combined. The maritime traders, and this means Europeans on one side and coastal Africans on the other, were probably already by the mid-1870s handling five or six times as much trade as the trans-Saharan merchants, and the disproportion was increasing. After the European conquest the trans-Saharan trade shrank to a trickle, and the maritime trade grew out of all proportion."(11)

Economically, the Sahelian colonies were exploited by a number of giant monopolies: C.F.A.O. (Compagnie francaise de l'Afrique Occidentale), S.C.A.O. (Société Commerciale de l'Ouest Africain-which had French and Swiss capital), and Unilever, a primarily British and Dutch holding company which dominated the world market in vegetable oils, and was represented locally by its affiliates: United Africa Company, Nosoco, Compagnie du

Niger Francaise, and the Compagnie francaise de la Cote d'Ivoire. The giant companies in the Sahel worked closely with the French administration to organize their depots and to obtain the raw materials they needed for export.(12) They utilized Labano-Syrians, some French and a few African merchants to distribute the goods that they imported. Initially, the people in the Western Sahel refused to abandon their traditional economic organization in order to produce crops for export. In order to force them to do so, the French administration levied taxes to be paid in European currency. When this proved insufficient, they instituted travail forcee which coerced local people to work on European plantations. The French organized champs du commandant or fields delimited by the police in which the local people worked collectively; and instituted "culture obligatoires" which stipulated that the local people had to produce so many tons of specific produce under the pain of severe physical and financial sanctions.

The nature of French economic activities in the Sahel neither contributed to the development of a viable local ecosystem, nor articulated with their imperial network. The dismal failure of their colonial economic enterprise in the Sahel zone could best be judged by what occurred in Upper Volta. In 1919 the new French Minister for the Colonies, Albert Sarraut, outlined a colonial development

plan (La Mise en valeur des colonies francaise) to build railroads, roads, plantations and other enterprises in order to expedite France's recovery from the ravages of World War I. In the newly created Upper Volta colony, an equally new Governor, Edouard Hesling, sought to implement this plan. He suggested that a colony "with such diverse products and such a dense population, could attain an exceptional level of development by acquiring those economic infrastructures that ensure prosperity."(13) Hesling believed that the Upper Volta could and should be able to produce and export "thousands of tons" of cotton as soon as an easy and economical way of shipping could be established. By 1925, he had built some 6,000 kilometers of roads in Upper Volta which represented, at that time, one-eighth of the entire network of roads in the entire federation. Meanwhile reports from Upper Volta commented on "the enforced enthusiasm with which the natives, under Mr. E. Hesling, have thrown themselves into agricultural labor and in particular into planting cotton."(14)

There were, however, some reports from the colony which indicated that the people were not happy with work on the champs du commandmant. Ossendowski reported that:

> "Cotton is an artificial crop and one the value of which is not entirely clear to the natives. The chiefs with their superior intellect, seeing the profit to be obtained from the plantation of cotton, are continually enlarging the area of the fields, and resort to draft animals, ploughs, manures, and even partial irrigation of the fields; nevertheless, the great mass of the population submit rather unwillingly to those instructions of the administration which aim at the development of cotton cultivation in the colony."(15)

When the Voltaics were not planting cotton and building roads, they were being recruited for both the French colonial army and for work in other colonies. In 1922, the colony was asked to furnish:

> "6,000 workers for the Thies-Kayes railway, replaceable every six months, and under the same conditions furnished 2,000 laborers to build railroads in the Ivory Coast. Similarly and with the consent of the chief administrator of the colony, it was possible to recruit a thousand workers in the regions of Ouagadougou and Bobo-Dioulasso for private corporations in the Ivory Coast." (16)

Buell states also that between 1921 and 1925, the upper Volta furnished the Thies-Kayes and Ivory Coast railroads with nearly forty-nine thousand men. In 1924, the Upper Volta Colony, in addition, employed men for a total of 318,814 man-days not including prestation labor and other local labor.(17) And Albert Londres reports that in the late 1920's the Upper Volta was considered a "reservoir" of manpower of 3 million people. Everyone went there to get men as they would "go to wells for water."(18)

Robert Delavignette, who served in the Upper Volta as a young district officer during this period, and who later became director of political affairs in the French Overseas Ministry, accused his government of attempting to destroy the Upper Volta local ecosystem. He declared:

> "In the course of ten years, 93,000 men were thus sent far away. They came back but without having learned a trade; having on the other hand, lost touch with their families, which had suffered by their absence and which could not be made whole by their return. Fields had been neglected, betrothed girls had not been married, wives had become under-nourished, children had been poorly cared for. The recruiters paid no heed to local labor customs. The young leaders of the age associations and of the rural cooperative organizations were not acknowledged (in their true roles) as monitors of peasant life and agriculture, but were seized as ordinary laborers and in preference to others because they were stronger. French Africa has lived on Voltaic labor in the Sudan, and notably in the Ivory Coast."(19)

Despite his draconian efforts, Hesling failed to develop the Upper Volta. Two explanations may be cited: (1) the efforts disregarded and/or damaged existing social institutions; (2) the price of cotton plummeted on the world market. By the mid-nineteen twenties, many young people who could not earn enough money to pay taxes or meet their familial obligations "left on seasonal migrations to the Gold Coast where they worked on cacao plantations and on the roads under much better conditions than in the Volta, and for better pay than in the Ivory Coast. There

were years when 80,000 men left to contribute to the fortunes of the Gold Coast."[20] And when in 1929 the cotton market failed, the economy of Upper Volta was in ruins. People could not pay their taxes; many of the roads that were too extensive, too little used and too difficult to maintain had to be abandoned; and the capitalists abandoned the country. The Colonial Minister ordered that the colony be broken up stating that this "would permit appreciable savings, and would make the administrative and technical personnel serving in its capital available for general service."[21]

The French treated a local ecosystem with its societies, natural habitat, and plant and animals resources as a plantation. When it failed, they attempted to liquidate it. A few French administrators who witnessed this tragedy bitterly commented that the Upper Volta with its faceless masses had posed a formidable challenge to administrators:

> "The more they tried to impose upon it an open economy with a pattern of roads, urban centers, and cotton fields; and the more they tried to discover the vital principle of that economy so that they could establish a new harmony between the land and those faceless masses, the more they broke down the old, established, traditional economy.... No original methods or powerful tools were used, no inventiveness nor clarity of purpose was shown. This was but a megalomanic copy of old patterns of mercantile

> exploitation, and [created] in the heartland, futile and joyless work for those faceless masses."(22)

The Upper Volta may have represented an extreme case of the failure of French economic policy in the Sahel, but as we shall see conditions in the other colonies were not much better. Hardly had the territories started to recover from the Great Depression, when World War II broke out and they found themselves caught in the conflict between the Vichyites and the Free French. Richard-Molard states that, during the period 1940-1943 when the Vichyites were in power, the words "Liberté," "Egalité" and "Fraternité" were officially effaced from public buildings. The local regime suppressed hard-won republican privileges in return for vague legal promises and applied repressive laws and decrees at will. Racism was rampant; the indigenat widely applied; arbitrary condemnations multiplied; and freedom of association suppressed.(23)

But the situation did not change in 1942 when French West Africa entered the war on the side of the allies. Then each colony, each cercle, each subdivision or poste was forced to join the war effort. Richard Molard recalls that at that period: "The 'war effort' justified all. Each cercle was imposed so many tons of vine rubber even if no such vines existed in its territory. The natives were thus sometimes forced to walk very far elsewhere to

buy rubber at almost any price in order to escape 'justice'. They sold it to the commander at a fixed price, several times cheaper than what they paid for it."(24) Rice was requisitioned and transported hundreds of kilometers by porters who often traveled twelve days without any provisions being made for them enroute. The Africans suffered in silence but were determined to seek redress at the end of the war.

Even before Germany surrendered, De Gaulle had promised the people of the western Sahel a better deal. They were to be integrated into a new political organization, the French Union, and were to be the beneficiaries of many new rights and duties. When the war did end, forced labor was abolished, local assemblies were created, new schools built, new hospitals opened, and a new economic infrastructure was promised. Attention was called to errors in the former system wherein development in the coastal areas and ports had "completely reversed the former patterns of circulation, and ruined the traditional pivots like Timbuktu, Djenne and Gao to the Profit of Dakar, Conakry, Abidjan, Cotonou and others."(25) The result was that the savanna world, foremost in West Africa's past, became the "interior sector", gravely handicapped by its continentiality, and the profit of the "exterior sector",

formerly marginal, increased. The French started to consider the fact that "the land-locked position of their West African possessions, cut off from the sea by the British colonies, presented a formidable problem in development."[26]

Whether one agrees or disagrees with those French colonial administrators and contemporary African scholars who claim that France almost ruined the Sahel in attempting to exploit it, it is quite true that the French were never able to transform the region to facilitate development; nor were they able to establish viable links between its people and the outside world. There is now widespread agreement that France's penetration of this area was marked by confusion and disorganization. While a number of statesmen such as Richelieu, Colbert, Napoleon III, Faidherbe, and Jules Ferry wanted to colonize the area, and merchant houses and missionary groups saw both material and spiritual riches there, many in Metropolitan France wished reassurance that their leaders would make no major commitment there. The result was that French policy in this region was characterized by half-hearted efforts, faulty planning, and uncoordinated development.[27]

After experimenting with military rule and local governments in its conquered territories, the French

decided to create a West African Federal structure (AOF) "to serve French interests and only indirectly those of the separate colonies; ... the colonies were always regarded as the fundamental political units and ... therefore the Federation was only a temporary structure."(28) Moreover, the Government General of the federation was not the product of creative and directed planning, but, rather, the product of a series of pragmatic and expedient policies having a variety of aims. Centralization was a response to the instability of the expansion process and a need to extend government authority, and the Governor-General, originally an administrative coordinator, became the repository of the powers of the Republic.

From his capital at Dakar, the Governor-General not only administered the Federal budget, maintained by indirect taxes and metropolitan credits, but also had the final word on the budgets submitted by the Lieutenant-Governors of the various territories, who convened each year in a Conseil du Gouvernement at Dakar. He promulgated metropolitan decrees, and supervised their enactment, and controlled the movement of French civil servants throughout the Federation. The Lieutenant-Governor of each colony had under his direction a number of Frenchmen who were the "commandants" of the cereles, subdivisions and postes

and the African chefs (chiefs) who headed the cantons and villages. A secretary-general provided liaison with the various units and functional departments of the colony's administration, and a Conseil d'Administration, consisting of the Governor, three officials, and three appointed "notables," was consulted on budgetary matters.(29)

The operation of this structure was constrained by various political contingencies and by inadequacies in funding, personnel, transport, and communications. The major problem was that of finance. The French Metropole provided little support since a law of 1900 required that each colony provide its budgetary needs through direct taxation. Indeed, Faidherbe's and French strategy, was "to dominate the country at as low a cost as possible and through commerce get the greatest advantages."(30) The result was that the colonies never had enough money, either for administration or for development. In 1910 the AOF had only one French administrator for every 5,547 square kilometers and 12,290 inhabitants, while in Upper Volta the ration was one per 60,000 inhabitants.

The lack of administrators had two important results. First, there was a substantial devolution of authority to too few administrators who had responsibility for order and justice, taxation, census rolls, and public works.

Secondly, there was the utilization of inexpensive local cadres including chiefs and technical subordinates. Thus the French, while advocating "direct-rule" had to practice a great deal of indirect-rule. To mesh theory and practice, they favored smaller political units (called chiefdoms). Such units could dovetail with the cantons, and provide a focus where the chiefs could execute, but not formulate policy. In fact Governor-General Ponty's Circular of 1909 advocated direct contact of administrators with the population labelled a "politique de races." He called for the recognition of local ethnic communities, and, in areas previously conquered by other Africans, recognized the antecedent political authorities.

The problem with this formulation of administrative policy was that there was confusion about the new status of the local political authorities: did they have power or did they not? Moreover, this new policy disregarded many elements in the traditional political culture, and exposed the rulers known as "chiefs" to the whims of local administrators. Chiefs who were allowed full discretion, and new power, inevitably committed "abuses" and "exactions", and were fined or dismissed accordingly. Even Governor-General Van Vollenhoven, (circa 1919), who was supportive of the chiefs, took care to underline the fact that "there

are not two authorities in the cercle, the French authority and the native authority: there is only one! The commandant de cercle alone commands...."(31)

The responsibilities of the chiefs, which covered the gamut of administrative tasks, tended to far outweigh their prerogatives and resources. This was evident in the area of adjudication as well as that of policy. After unsuccessful experimentation with the extension of French justice, the chiefs were made an integral part of the federal judicial system in 1903. In 1912, however, the judicial function of chiefs was restricted to conciliation, and the relative weight of French law as opposed to customary law, increased. The discretion of colonial officials was heightened by the system of administrative penalties called the indigenat, applicable to all non-citizens. Any administrator could summarily fine people up to 100 francs and jail them for 15 days for any of 26 infractions -- evasion of taxes, labor dues, or sanitary regulations, disrespect towards authority and so on. Not even the chiefs were immune to such penalties. Rendered impotent by an administration too insolvent to finance the development of the area, the chiefs became the tools by which the administration sought to use local resources for development. The chiefs were forced to mobilize both people and resources

for work on projects which were meaningless to them. Both they and their followers suffered in the process.

The restructuring of the traditional political institutions of Sahelian societies in the interest of producing export crops resulted in a number of constraints on development especially a distrust of political authority. The rural people saw their traditional chiefs and nobility transformed either into willing tools of the administration, or abused and humbled by outsiders. Some populations had used "chefs de paille", (literally chiefs of straw), in an attempt to protect their true leaders from desacralization; others suffered the maladministration and extortions of "manufactured" foreign chiefs imposed by administrators practicing the old technique of divide and rule. Many peasants resented being forced to cultivate crops that they did not use or need, and which did not fit into their traditional agricultural cycle. They resisted paying taxes with European currency, a device which was designed to induce them to migrate for work, and to enter a money economy by selling their subsistence and services. The result was that for many cultivators or peasants, African political figures lost their legitimacy, if not their power and authority.

Advocates of change encountered subtle but often effective opposition from people who had learned to

distrust outsiders -- even neighbors; for experience has shown that outsiders rarely bring gifts. Official public relations campaigns to induce people were often ineffective because most rural persons had been exposed to campaigns which did not benefit them. In almost every cercle or district headquarters there were dismal remains of the technical paraphernalia of projects that did not work. The result was that peasants, grown wise in the ways of the Europeans, were loathe to respond to innovations even when assured by their leaders of the possibility of success. The problem was that despite their oppositions many rural people hesitated to speak out, thereby suggesting by their silence their acquiescence. The denouement came much later when the innovation failed and frustrated officials were too embarrassed to admit that the peasants had never really agreed to the projects in the first place. The economic constraints on accepting innovation were often difficult to overcome. People who lived very close to the subsistence level were reluctant to innovate, because failure could spell disaster.

For example, the patterns of nomadism and agriculture practiced in the region had evolved over time. By the 1950's they represented adaptation to the demands of a colonial system which had insisted on the production of export commodities. In other words, slow but steady

changes did take place during the colonial period. Ironically, sentiment persisted both among the pastoralists and administrators, that the herders preferred transhumance and a migratory life to agriculture, despite the presence of a growing sedentarisation of pastoralists and their adoption of a mixed economy when conditions were suitable. In Niger, Dupire found that the Fulani passed relatively easily from one type of pastoralism to the other, and became sedentary mixed-cultivators. This was proof of their ability to adapt to changing conditions. She concluded that "Nomadism is not a mystique for the Fulani, but a submission to the conditions in the physical milieu which, moreover does not blind him to the advantages of the sedentary life."(32) Tuaregs and Bella (Bouzou) also became sedentary when the circumstances permitted. They adapted mixed-agriculture using cattle to fertilize fields, and sent young boys into the bush with herds during the planting season. They, too, took advantage of the two economic possibilities present in their environment.

Dupire concluded that the biggest problem in the Sahelian region was always the lack of water. She was convinced that the creation of wells "would resolve this painful dilemma for the sedentaries as well as for the pastoralists."(33) What was not understood by the French

was that the Fulani, Tuaregs and other Sahelian pastoralist populations had a fairly good idea of the number of animals required to support their families under ordinary (and perhaps the worst) conditions. They tried to maintain this number even in the face of administrative pressure. Often their behavior appeared bizarre to foreigners, and other Africans, since they did not sell their cattle at the most propitious time to gain the maximum profit. But there were environmental, cultural, as well as moral reasons for this type of behavior. The possession of cattle did give the herder "social prestige which he can acquire in no other way and gives him psychic satisfactions in comparison to which the enjoyment of foreign goods or luxury articles remains qualitatively negligible."(34) But there were such practical considerations such as the fear that the money obtained by selling their stock might be stolen or lost, not to mention the temptation to spend it for trivial purposes. Thus the resistance of pastoralists to sell their cattle for money was in very many cases, the "reflection of a wise prudence," at least so long as they did not feel that their own security and that of their cattle, in an ungrateful region, had been brought to a new economic equilibrium.(35)

The problem for the herder and innovators alike was that their ideologies, beliefs and values often lagged

behind the technical changes that had occurred. They often took emergent patterns for granted without even acknowledging a change in the pastoral way of life. The pastoralists were willing to change, and they were anxious to increase their revenue. Nonetheless, like most people, the herders were not willing to change their economic behavior unless they were convinced that they would directly benefit. Force was used periodically to compel the pastoralists to contribute to the "public good" but the pastoralists always reacted by escaping these constraints even though their own behavior was changing in the direction sought by the administrator.

The relations between the nomads and the settled agriculturalists in the Sahel had also not been static, but had been evolving over the years. The nomads exploited lands too marginally unproductive for the agriculturalist's use, and moved into the agricultural areas during those periods when their normal habitats were too desolate to maintain their flocks. Under ordinary conditions the agriculturalists welcomed the presence of the herders. Stenning, who worked in Northern Nigeria during the colonial period, describes an extensive symbiosis between pastoral Fulani and the neighboring agriculturalists. "Except perhaps in the Sahel," he tells us, "the pastoral life is pursued not in isolation,

but in some degree of symbiosis with sedentary agricultural communities. Alongside the continuous exchange of dairy products for grain and other goods, there have existed, possibly for many centuries, arrangements for pasturing cattle on land returning to fallow, and for guaranteeing cattle tracks and the use of water supplies. Pastoral Fulani did not, and do not, merely graze at will, but obtained rights to the facilities they required from the acknowledged owners of the land. The payments in kind made for obtaining the rights were not merely economic transactions but involved the Pastoral Fulani in the local ritual observances relating to land."(36)

Sometimes transhumance led to conflict when both herders and pastoralists competed for the same areas. When and where the pastoralists were victorious, they not only took over the lands of the agricultural populations, but often established a kind of patron-client hegemony over certain groups of agriculturalists (Bella or Bouzou). When, however, the pastoralists were bested, they moved off with their herds to seek better arrangements with other agricultural populations. Even during the colonial period, when periodic droughts and epidemic diseases decimated some herds, many pastoralists temporarily adopted agriculture. However, as soon as their herds

recovered they resumed their nomadic existence, even though they retained viable relations with the agriculturalists.

The conquest of the Sahel and its incorporation into the French colonial empire did affect the relations between the nomads and the sedentaries. The abolition of slavery freed the agricultural captives of the pastoralists, although it did not end the patron-client relationship between them. The French attempted to sedentarize the pastoralists in an effort to curb their mobility and to incorporate them into the colonial structures that were being implanted. The pastoralists often escaped by crossing territorial borders, and were able to resist sedentarization and to avoid involvement in the many schemes that attempted to develop the region. The irony was, that once many agriculturalist schemes were launched, the pastoralists were unable to move their flocks into areas as in the past. Moreover, they gained the reputation of resisting all change and were viewed with disfavor by both the agriculturalists and the administration.

Despite their mobility, the pastoralists were unable to withstand the intrusions of the colonial regime into their affairs. Gradually the French district commanders persuaded the Fulani rulers to settle down, and to serve

as links with the nomadic populations. The result was status differentiation within formerly fairly egalitarian populations. Gradually, the influence of the colonial regime's activities led to an increase of population among both the human and animal populations of the nomads and agriculturalists. The nomads, being less valuable than the agriculturalists to the colonial system, were at a disadvantage in this competition. Lack of education, and lack of knowledge of the colonial institutions reversed the status relations that formerly existed between them and agriculturalists. It was only in the areas truly marginal to the administrative centers that the traditional patron-client relations between the nomads and the agriculturalists persisted. As more persons from the agricultural societies joined the subaltern cadres of the colonial regimes, they eradicated "feudal-like relations" between the nomads and their agricultural vassals.(37)

Every extension of the colonial regime into the traditional economic and social relations of the nomads and the sedentaries, eroded nomad dominance or privilege. The exception was in Mauritania where the demographic superiority of the Islamized nomads did not facilitate the development of the colonial-derived high status of the sedentaries. However, even here the nomads were at

a disadvantage since they were victims of an alliance between the sedenterized nomadic peoples and the agriculturalists pitted against those who remained truly nomadic. The split between the Town Fulani (Gidda) and the "Bush" Fulani (Boroje) that occurred in Nigeria was replicated in the western Sahel. In Nigeria, the ethnic factor which linked the two Fulani communities, became less important than those factors that linked the Town-dwelling Fulani and the Town-dwelling Hausa. By the end of the colonial period the ability of the nomads to continue their way of life was increasingly being threatened. As agricultural populations improved their techniques they were increasingly reluctant to permit pastoralists to use their lands.

One of the major issues that faced colonial administrators in the field of agriculture was whether or not cultivators would agree to adopt individual tenure. Indeed, many agronomists argued that African agriculture would never become efficient unless the peasants shifted from "farm tenure" or "usufruct" to individual holdings. Pelissier, who studied agriculture among the Serer of Senegal, contends that without institutionalized individual tenure, and mixed farming, the multiple pressures of demographic increase, Islam, the exigencies of a commercial

economy and the spread of urbanization could have grave implications for their society. He concluded that "the issue is less in discovering technical solutions than in substituting in one way or another the concept of 'geographic patriotism' for the present 'biographical patriotism' which among the Serer would facilitate the introduction of a genuine land tenure system."(38)

The issue here was perhaps not individuation of land tenure per se, but what this change might have meant to the relationship among people in a lineage, the institution in which land, and other goods and services, was vested. Individuation in land did imply individuation in family or lineage relationships. But if lineage membership meant anything, it meant the mutual cooperation of its members against the exigencies of life, particularly the economic ones. A man therefore unconsciously resisted detaching himself from his lineage in order to cultivate his own plots, unless he was assured that he would receive a just return for the fruits of his labor. The problem during the colonial period was that there was no such guarantee. And unless people could have been assured that they had the ability to survive isolation from their lineage through the individuation of land, they would remain linked to the lineage and through it to the traditional farm tenure system.

The spectacular growth of vegetable gardening, (jardins maraichers), in and around the emerging towns and larger villages in the Sahel, at the end of the colonial period, suggests that cultivators willingly adopted modern forms of agriculture, and that the issue of individuation in land was not proving insoluble once the benefits become clear. Near every dam, waterhole, or stream in the vicinity of these agglomerations were peasants cultivating garden vegetables in order to supply the urbanizing populations. In many cases, these plots were acquired by the peasants using traditional land tenure practices. The potential user sought permission to use the land in return for goods and services. If the land was unused, the owner or custodian permitted the applicant to use it,with the stipulation that tenancy was assured unless revoked for particular reasons. In any case the question of tenure was muted since the crops cultivated were annuals, that is, they were sown, cultivated, and reaped during the course of a single year. Thus, if the proprietor wished to regain his plots, he simply gave the occupant one year's notice to vacate. And since the occupant had not tied up too much labor and capital into the land he saw little difficulty in surrendering the plot. Of course, the situation would have been different if the occupant had planted perennials

and had invested a great deal of capital in the plots. The significant fact is that the issue of individualism in land seldom arose unless the proprietors tried to retake the plots to give to persons who promised more money or gifts.

So important was the income from the vegetable gardens that this type of cultivation diffused from the large urban centers to the country districts. One district commandant in colonial Upper Volta told the writer that the future of agriculture in his area lay not in traditional agriculture, that is, cultivating the cereals or cotton, but in the _jardins maraichers_. The problem for this official was how to get the necessary water supply for these projects. He felt that by doing so he could retain the young people in the rural areas where they could produce enough food for themselves, and for export to larger towns.(39)

Few attempts were made by the administrators during the colonial period to expand these small-scale holdings into large-scale agricultural complexes. True, some administrators favored certain chiefs by permitting them to dragoon local labor in order to increase the acreage of fruit orchards. This was especially true in the Upper Volta and in most of the territories in the Sahel. Yet the main problem for any such large undertaking was the need for water, although the experience at the _Office du_

Niger during the colonial period suggests that water was not the only problem. The problems posed by expansion in scale of all the agriculture projects in the Sahel were major ones. When large-scale projects were developed, the major decisions were taken out of the lands of local peasants and agronomists, who were often unfamiliar with the historical vagaries of the area, were placed in charge. Even when they were sympathetic to folk wisdom, they were not able to ask the relevant questions. The waning colonial regime introduced cooperatives, but these cooperatives, linked to larger systems, were often incapable of responding to local concerns; in order to maximize their efforts, they had to make greater demands on the local systems than could be met. The result was often conflict; missed schedules in production; misunderstanding of price accords; charges of mismanagement, corruption and stupidity; and the breaking of agreement by either the regime or the peasants. The perennial problem was: how could one move from efficient small-scale production to large-scale production without tremendous problems? Was it possible to incorporate the emergent small-scale changes into a larger system of change, rather than to impose drastic change on local systems that had no way of coping? This problem was never satisfactorily solved during the colonial period.

Colonial attempts to improve agriculture and livestock production in this region through large-scale projects, large-scale ranching schemes, and small-scale mixed farming did not pay much attention to the role of women. True, the administrators all recognized that traditionally women had always participated in the herding and agricultural work in Sahelian societies. Among the Fulani, women milked the cows and young girls helped the boys herd the cattle. Wolof, Bozo, Serer, Mossi and Songhoi women helped the men sow, cultivate, and harvest crops. Women toiled beside men in the cooperative fields of their extended families and, in addition, had small individual plots where they cultivated vegetables, condiments for sauces, or tobacco for sale in markets. Nevertheless, French colonial administrators always hesitated to use African women in the agricultural schemes that they introduced. Most of the administrators came from the urban centers of France, and had the impression that only men were suitable for agricultural work. Ironically, some administrators used women to transport cotton to the large collection centers and to level roads with iron rollers. These were criticized by the Africans who resented their female relatives being subjected to European forced labor, and by European missionaries and travellers who viewed such work by females with horror.(40)

Most administrators in the Sahel were not cognizant of the increased participation of women in the traditional agricultural sector as men withdrew from this work to serve as forced laborers, forced cultivators, soldiers, or as seasonal migrant labor to distant regions. True, the women seldom cleared new fields, but they intensified their activities in other aspects of agricultural work, and reduced the amount of time they spent on their individual fields. As the fertility of the over-used fields declined, the ability of women to increase food production also failed. Thus the women, though unseen, were victims of the economic problems of the Sahel.

Post World War II, pre-independence attempts at introducing voluntary changes in agriculture in this region usually did not involve women. Then, too, the reasons were largely cultural. Westerners, and educated Africans were loathe to place African women behind the animal-drawn plough, the most widespread type of agricultural innovation. Again, most officials did not consider sending the few educated African women to foreign schools or to any school in order to learn improved agricultural techniques. They felt that these women were desperately needed in other crucial areas of development, particularly in agencies devoted to social change.

It is difficult to get an objective balance sheet on the European colonial period in the Sahel, or for that matter in any part of the world. Africans and other colonized peoples vie with the Europeans to determine who profited or lost the most as a result of the expansion of the West. Many Third World persons are convinced that their societies were raped and under-developed as a result of European colonization. The Europeans, on the other hand, point to the improvements they had made in the lives of their colonies in order to justify any exploitation that may have taken place. Ironically, there is an emerging school of European historians who insist that the Europeans made a sad mistake by establishing colonies. According to these scholars, the Europeans would have done much better had they expended their energies and their treasures in other pursuits. There is every indication that this debate will continue, especially since both the Europeans and their former "subjects" are still living in the backwash of the colonial period, and inevitably are affected by it.

Demographically the Sahel has never been densely populated. For example, Mauritania (which is larger than Texas and California combined) had less than one million people during most of the colonial period and the majority

were nomadic herdsmen. Mali, with an area of 461,300 square miles, had 3 million inhabitants. Upper Volta, which is as large as Colorado, had only about 4 million people during the colonial period, and Niger, with 494,000 square miles, had only about 2 million inhabitants. Chad, with over 2 million square miles, had less than 3 million people, even though its southern part was well-watered. Richard-Molard indicated that not only were the Sahelian populations small, but "the more the density of the population increased, the more man is penalized by having to work land that becomes more ungrateful the more one asks of it."(40)

Almost all the Sahelian governments found that although they would have liked to limit the amount of money spent for social services in order to develop their productive sectors, demographic changes as well as rural-urban migration prevented them from doing so. As a result of inter-war and post-war development of health services, the population of the six Sahelian countries passed twenty million (today it is between 22 and 23 million) and is increasing at the rate of about 2.0 to 2.2 percent per year. Even if the governments had developed a population policy, they did not have the means to institute family planning and this is a more complicated problem than many

people are willing to admit. The result is that the populations are still growing, and the people are demanding employment, goods, and services. When these are not available in the rural areas, people migrate into the urban areas, putting pressures on weak urban economies and depriving rural sectors of their labor and the government of rurally-derived taxes. The failure of the Sahelian states to provide economic opportunities to their citizens has contributed to the fall of two governments in the region.

A number of these factors were operating in the Sahel when nature added to the woes of the region and threatened its ecosystem. Many geographers and climatologists assert that since 1940 "something has intervened to make the earth cooler and to make the dome of cool air covering the polar regions increase in size."(41) This has resulted in the gradual displacement of all climatic zones a few latitudinal degrees closer to the equator. Thus, while the equatorial regions received more rain than usual, there was a growing crisis in the Sahel where, in the words of one climatologist, "life is balanced on a knife's edge by the success or failure of the summer rains." Since about 1966, local meteorologists have noticed a net diminution of rainfall in an area which

normally received between 100 and 400 mm from May or June to September or October. Some climatologists suggest that the change was cyclic; one famine occurred in 1910-1914, another in 1941-42, and another one was due in the 1970's. Other scientists did not believe that there were enough data to indicate either that the droughts were cyclic, or that they were the result of permanent changes on a continential scale. Moreover, these people denied that the Sahara was spreading south thirty miles a year. Most climatologists do agree that the World Weather Watch system should be made more effective so that macro changes can be foreseen and people can be warned when to expect changes in their micro systems.

By 1970, the Sahelian populations noticed a rapid decrease in rainfall, and by 1972 they realized that their ecosystem was seriously threatened. In less than three years the water table throughout the region had fallen some 20 meters or 100 feet. The Senegal river which normally crested at 26 feet during the height of the rainy season, crested at only 18 feet in 1972. Lake Chad, whose fluctuations have always been a guide to the amount of precipitation in the region, dwindled to one-third its normal size. In 1972 it contained only 12,000 million cubic meters of water, whereas in 1970 it had contained 31,000 million cubic meters.

The effect of drought within an area of increasing aridity was disastrous for the biota: plants, animals and people. For example, in Senegal where the normal rainfall is some 300 mm, only 60 to 120 mm fell. The result was that the 600,000 tons of peanuts and about 700,000 tons of millets and sorghums harvested in 1970 would be reduced by one-third, and by 55 percent in 1973. The shortage of water and pasturage actually reduced the Senegalese livestock population of 2.7 million cattle and 2.8 million sheep to about 20 to 40 percent. Comparable or worse figures were gathered from the other countries with Mauritania and Niger being especially hard hit. So drastic was the shortfall of crops in the region, that by March-June 1973, (known as the "hungry-period" because the previous year's food is almost exhausted and the new crops are not yet harvested), some two million out of Mali's population of five million had been affected by hunger and thirst; the United Nation's FAO had declared the Upper Volta a class D drought area; and hundreds of thousands of people in Mauritania, Niger and Chad were fleeing the northern areas and were congregating around the southernmost towns and cities.

A shocked world discovered with alarm that, unless emergency measures were quickly taken, some six to ten

million people might die of hunger.[42] To add to the tragedy, there were reports that cholera, virulent measles, scurvy, meningitis and other diseases brought on by malnutrition and poor sanitation were on the increase. The threat of pestilence was added to the misery of famine. The children of the region were especially devastated; in Niger infant mortality is normally close to 50%, and drought and famine greatly increased this mortality rate. Government and relief officials feared that unless help came quickly, the herds of the nomads would decrease beyond recovery, and the human populations would consume their seed grain and thus be unable to plant crops for the 1973/1974 year.

There are still many questions, arguments, and discussions about whether the governments in the Sahel region were aware of their growing plight; whether or not their alleged early pleas were heeded by a world engaged in other affairs; whether the aid that was sent was too costly, too little and too late; and whether the aid that was sent was badly used, or not sufficiently acknowledged or appreciated. This was to be expected given the extent of the disaster, the passions it aroused and its economic, political, social and technical implications. What is not contestable is that the Sahelian ecosystems -- under

enormous pressure for decades -- have been badly impaired. Unless the reasons for this are understood, all discussion will be in vain and will not lead to the restoration of equilibrium or the elaboration of a larger and more viable ecosystem.

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III. THE FULANI IN A DEVELOPMENT CONTEXT

Paul Reisman

Paul Reisman lived among the Fulani, in Upper Volta for nearly four years, accompanied by his wife and subsequently his two children. He speaks the language fluently and feels that he has come as close "as any American has to understanding their mentality and grasping the logic of their way of thinking". He is Associate Professor at Carleton College, Northfield, Minesota.

Introduction

The Fulani of West Africa are one of the major cattle-raising peoples of the world. They are unique among African peoples in the degree to which they are scattered over a vast area; not only are there significant groups in every state of West Africa, but they also live in Cameroon, Chad, the Central African Republic, and Sudan. Over half the Fulani do not raise cattle today, but there are million who do and they are concentrated for the most part in the poorest countries, not only of Africa but of the world. This is significant, because in countries with little manufacturing,

and few saleable natural resources, the exporting of meat can become a major source of external revenue for the state.

The growth of population in Africa and the rapid expansion of cities, makes for an unprecedented rise in the demand for meat, a demand already felt in the Fulani areas in the form of higher prices for cattle. Governments are under pressure to increase meat production because of the dual need to make more meat available and to improve their balance of payments situations. Thus, even if the Fulani had no problems of their own, they would still have to face the direct and indirect consequences of the key role they play in tending and regulating the beef supply in the countries where they live. In all the countries where the Fulani are significant minorities, the governments are hoping to increase meat production and sale by encouraging economic development projects among the Fulani. The United States Agency for International Development, as a major donor of economic aid around the world, is naturally called upon to bring American expertise to bear in this sort of endeavor. Economic development projects in underdeveloped countries, particularly among livestock raisers, create several dilemmas, both moral and practical. In addition to the basic question of whether we have the right to interfere at all in other people's

lives, there is the more immediate issue of whether the procedures we use to try to bring about development are moral -- in other words, do we end up treating the people with respect for their integrity? On the practical side, do the projects really work? That is, do they gain acceptance among the people who are supposed to benefit from them, and do they have few enough mitigating and deleterious side-effects for a net improvement over the way things were before? Not only in foreign aid, but in our own country as well, we are becoming more aware of long-term effects such as build-up of pesticides in body-tissues, excessive erosion and loss of watershed through deforestation, silting up of hydroelectric dams, etc.

A major snag in many overseas development projects has been the human factor, not simply error, which is always with us, but rather the social structure, way of life, and world view of the particular people for whom a project is designed. Failure by development experts, to take these aspects of the problem into account, inevitably results in one or more of the following difficulties: 1) radical misinterpretation by the target population of what the experts are trying to do; 2) significant disruption of an ongoing way of life, with the benefits going just to a few rather than to the majority or to all; 3) deterioration rather than improvement of the economic situation due to

the manner in which the target population makes use of the facilities or other changes created by the project. This list could be expanded.

This study is aimed at reducing these difficulties in the case of the Fulani and whatever development projects might be tried among them. Once we have a commitment to acting morally, e.g. renouncing the use of force, our hope of reducing these difficulties rests on achieving a deep understanding of the Fulani way of life as a total system, and on correctly analyzing how changes introduced at various points in the system might affect its over-all functioning. This paper is meant to be a tool that will help specialists of any kind understand the Fulani better and thus use their expertise to serve them more effectively. It is important for the reader to realize that this study may not specifically cover the particular case with which he is dealing, but it should give him a way of thinking about the Fulani that he can apply to any case.

1. Who Are the Fulani?

We have seen that the Fulani are a very far-flung group but they are also one of West Africa's numerically largest groups. With a total estimated population of nine or ten million, they number in the same order of magnitude as the

TABLE 1

FULANI POPULATIONS BY COUNTRY

Country	Year of Census/Source	Number
Benin	1952	54,000
Cameroon	1960-61	400,000
Chad	1964	32,000
Gambia	1954	58,700
Ghana	1950	5,500
Guinea	1970	1,500,000
Guinea-Bissau	1948	36,500
Ivory Coast	1952	52,000
Mali (estimate based on cattle population in 1975)		400,000
Mauritania (Peul)	1962	40,000
Mauritania (Toucouleur)	1962	70,000
Niger	1962	247,143
Nigeria	1972	4,800,000
Senegal (Peul)	1969	560,000
Senegal (Toucouleur)	1969	442,000
Upper Volta	1974	300,000
TOTAL		8,997,843

TABLE 2

FULANI POPULATIONS BY MODE OF LIFE

Pastoral		Sedentary	
Nomads	93,300	5,886,400	
Semi-sedentary	3,018,143		
TOTALS	3,111,443	5,886,400	8,997,847

Hausa, Igbo, and Yoruba of Nigeria. They do not form a majority in any West African state, but they are very large minorities in all the sahelian states, as well as in Guinea, and Fulani groups dominate particular regions within those states. Table 1 gives the figures for the Fulani population of most of the states where they live. Please note, however, the different census dates. More recent figures surely exist in some cases, but these are the best that were available, and even the most recent figures are but approximations. One reason for this, as we shall see shortly, is that different people define who is or is not a Fulani differently.

There is a major division between two life-styles lived by the Fulani, the pastoral and the sedentary (agricultural and urban). It is only the pastoral Fulani that we are concerned with here, and the main variants of that way of life, namely the nomadic and the semi-sedentary. While nomadic and semi-sedentary Fulani frequently shift back and forth from one to the other variant of the cattle-herding life, once Fulani have given up cattle-raising for some other occupation they rarely go back to it again.

Those Fulani who are now sedentary probably had ancestors who were pastoralists. The origin of the Fulani is the subject of much speculation. Some writers have suggested that they were one of the lost tribes of Israel,

or that they originally came from south India, but modern linguistic and historical research connects the Fulani with the banks of the Senegal river some time during the first millenium of our era. Assuming that the Fulani herded cattle then as they do now, small family groups periodically hived off to look for new pastures or to get away from unpleasant situations. They moved eastward and lived among whatever populations would accept them in the sahelian zone. As they became numerous in an area, they would begin to become dangerous to the people who had originally let them live there. Sometimes they were driven out, and sometimes they would take over the land themselves. One of the first times this happened, if not the first, was in the region they may have come from, namely the Futa (or Fouta) Toro. Very little is known about the history of that region, somewhat on the margin of the better known ancient empires of Ghana and Mali, but it is clear that there have been dynasties of Fulani rulers there since the 15th century. In the mid-eighteenth century there began to be a sort of Fulani ferment throughout West Africa. John Grayzel suggests that this might well have been set off by a progressive increase in the value of cattle in foreign markets; when gold and slaves had been Africa's main export, those who controlled

those resources held power, and when cattle became important, then those who controlled them rose to power (1977: 209-216). This hypothesis makes a lot of sense to me, and I would only add that a significant increase in population must also have taken place. The first of these take-overs by Fulani happened in the Fouta Djallon of Guinea, and it was organized as a holy war (jihad). During this same period there was a dynastic change in Fouta Toro, but it was not a matter of one ethnic group overthrowing another. (My own research in the Jelgoji of Upper Volta suggests that the next Fulani revolution took place there; to my knowledge, it is the only such revolution that took place without a jihad.) Then, in the early nineteenth century there was a whole series of uprisings, sparked by Usman dan Fodio in northern Nigeria, and then followed by Fulani in Liptako (region of Dori, Upper Volta), Cameroon (Adamawa region), and Macina in Mali. In all these just named regions the Fulani states that were set up continued to function until the colonial conquests, and in many areas, but not all, they still function today.

One source of evidence supporting the idea that Fulani expansion was both fairly recent and fairly rapid is the Fulani language itself. This language, called Fula by linguists and Fulfulde by the Fulani, is mutually comprehensible by speakers from nearly all areas. (I myself

was taught by a professor who knew the dialects spoken in Cameroon; he was assisted by a Fulani from Guinea. When I arrived in Upper Volta I found that I could understand and be understood by the speakers there. I later made a short trip to Senegal and could speak with Fulani quite easily.) There are certainly differences in dialect and accent, but they are not greater than the differences between the French of Paris and of Quebec, or even Marseilles. The only exception to this rule is found where there is a small enclave of Fulani surrounded by speakers of another language. In such cases the Fula is so influenced by the other language that it is difficult to understand. Such is the case, for example, in Barani, in northwestern Upper Volta; there, the Fula is heavily influenced by the Marka language. In Dokui, a nearby village settled by Fulani of the same stock, people no longer speak Fula, only Marka.

In contrast to this relative homogeneity of language among the Fulani, there is a plethora both of groups and of names of groups. Fulani is a Hausa word that was taken over by the English in Nigeria and has since been used by most English-speaking writers. The Fulani of northern Nigeria are by far the largest single group (see Table 1). Most of them are sedentary and no longer speak Fula but Hausa, the language of the people they revolted against in

the nineteenth century. These Fulani are sometimes called "Hausa-Fulani". C. E. Hopen estimated that 18.2% of the Fulani in Sokoto Province were "Cattle Fulani", and if that estimate approximates the proportion in the country as a whole, 873,600 Nigerian Fulani would be nomadic and semi-sedentary (Hopen, 1958:5).

Most of the rest of the Fulani live in countries that were formerly colonies of France. In those countries the most common name for the Fulani is Peul. This is the word used by the Wolof, the dominant population of Senegal, and it is the usual term used by French-speaking writers. Thus, the words Fulani and Peul refer to exactly the same ethnic group. In parts of Guinea, Sierra Leone, Gambia and Senegal, the Manding word Fula is used to refer to the Fulani. In Mauritania and Senegal, in the inland delta region of the Senegal river, lives a large population of sedentary Fulani called Toucouleur. All Fulani except the Toucouleur call themselves Ful'be (the apostrophe indicates a glottalized sound). The Toucouleur speak the same language as the other Fulani, but they call the language Pular rather than Fulfulde, and they call themselves Haalpular'en ("Pular-speakers"), It makes no difference for this study whether the Toucouleur are really Fulani or not; even though they consider themselves distinct, their

social structure has been a sort of model for Fulani chiefdoms nearly everywhere, and most Toucouleur terms for different social categories are everywhere in use.

Let us look at a few of these terms, for they are important to know when dealing with Fulani. Toucouleur society, as well as other sedentary Fulani societies and most semi-sedentary ones, consisted in pre-colonial times of distinct groups or "castes" of people hierarchically ordered. At the top were the Ful'be (sing. Pullo) everywhere except in Toucouleur society itself, where the noble class were called Tooro'bbe (sing. Tooroddo). Then came a number of hereditary artisan castes such as blacksmiths, weavers, woodworkers, singers; there was also a caste of courtiers or councillors. All members of these groups were considered free (rim'be, sing. dimo), in contrast to people of servile condition called riimaay'be (sing. diimaajo) and maccu'be (sing. maccu'do -- the letter /c/ in Fula is always pronounced like the /ch/ in "cheese"). We won't be concerned with the Toucouleur any more in this essay, but the distinction between noble and slave, Pullo and maccu'do, has been basic to the shaping of Fulani society as it exists today. We shall see later on how important the slaves were in the precolonial Fulani economy, and what effect the abolition of slavery had on that economy.

For the moment I simply want to point out that the descendants of these slaves, together with members of other "castes", are normally all counted as Fulani in the census figures we have. This fact can make a considerable difference when we are trying to estimate the number of pastoralists in a given area. Jean Gallais, for instance, in his study of the Mali Fifth Region, found that the "Peul group" amounted to 38 percent of the region's population, while the "true Peul" were only 20 percent of the population (Republique du Mali, 1972:19). In addition, when asked in French whether they were "Peul" or not, members of other castes might well say yes, while they would be unlikely to say that they were Ful'be unless far from home where no one could contradict them.

Finally, it should be pointed out that the non-Ful'be strata of Fulani society, especially the maccu'be and the riimaay'be, may have the most to gain from political and economic development. The Fulani have good reasons to want to conserve their position in society, but the maccu'be have good reasons to want to change theirs. Thus, it is perfectly logical that the "conservative" Fulani generally have rejected modern education, while the "progressive" maccu'be have sought it. Ironically, this education has now made it possible for some maccu'be to

return home as government officials and to rule their former masters. We may permit ourselves to smirk momentarily at this "logical" response of the Fulani, but this is precisely the kind of behavior that needs to be looked at more closely. We mustn't jump to the conclusion that we understand it simply because it makes a neat contrast to the way the maccu'be have acted. If we do jump to such a conclusion, we in effect close the door to further understanding because we stop trying, and we thereby curtail our effectiveness as agents of beneficial change.

2. How the Fulani Live

Very few Fulani today are true nomads -- that is, people who move from place to place with no fixed home and who live entirely off the produce of their herds. The life-way of the nomads has an importance out of proportion to the number of people practicing it for several reasons. The chief of these is that some degree of mobility is crucial to the life of most of the Fulani we are concerned with in this report, and the values and practices of the nomads are a kind of model of that aspect of life. Second, a study of how the nomads live, when compared with semi-nomadic Fulani, increases our understanding of the range of possibilities for life in, and

exploitation of, the sahel environment. Third, it is important to remember that the word nomad, in Africa, has often been misused as a synonym for pastoralist, and that being a pastoralist by no means necessarily entails being a nomad. Finally, the reason for this misuse is itself instructive, for it probably stems from the extreme dispersion of the Fulani in West Africa when compared with all other ethnic groups. When compared even with other "nomadic" peoples, such as the Maures and the Tuaregs, the Fulani have not limited their movements to particular areas, but have moved, often quite rapidly, among populations long established in the sahel and have begun to exploit the environment in their own, distinctive manner.

Because the Fulani, both nomadic and semi-nomadic, move so easily from one area to another, counting them is extremely difficult. Even today, Fulani who have lived for years in one area may be on the tax rolls in a place a hundred miles away, and actually pay their taxes there because that is where the head of their family lives. Thus, all figures in this report, or any report must be regarded as approximations at best.

The region where the largest concentration of nomads is found is the area known as Bornu near Lake Chad on both sides of the Niger-Nigeria frontier. In Niger, this is

the Maine-Soroa district, and in Nigeria the province of Bornu. By far the majority of these nomadic Fulani belong to the group that calls itself Wo'daa'be, and is often known to members of other tribes as Bororo. Not all nomadic Fulani are Wo'daa'be, but nearly all Wo'daa'be are nomadic. The largest numbers live in Niger (50,000 - Dupire, 1970:16), Nigeria, Bornu province (6,000 - Stenning, 1959:210), and on the Ngaoundere plateau in Cameroon (7,300 - Dupire, 1970:16). Smaller pockets of Wo'daa'be can be found in other parts of northern Nigeria, in Mali, and in Senegal. There are probably about 20,000 or more nomadic Fulani of other groups in Niger (Dupire estimated 17,519 in 1962), and my own guess is that there are not more than 10,000 others practicing this way of life in the whole of West Africa. This gives us a total of 93,300.

In contrast to some East African pastoralists, such as the Masai (Jacobs, 1975), no Fulani group, to my knowledge, lives day in, day out, on the products of its herd alone. The Fulani do not make use of the blood of their animals to drink or any other way, and though at certain times of the year they may live on milk alone, millet is the staple of their diet almost everywhere in West Africa. It is a basic given of nomadic Fulani economy, then, that there is trade with agricultural

peoples. In regions where agriculture is possible the Fulani either constitute a small minority of the total population (in which case they can be nomadic and trade with the agriculturalists), or they make up a larger segment of the population and in that case must cultivate their own fields. This arrangement, practiced by the vast majority of pastoral Fulani, is what we will be calling semi-sedentary.

There are two major points to remember concerning the economic base of nomadic life when looking at it in a development context: 1) the first is that a group's herd make-up is such that, in normal times, the people can satisfy all their subsistence needs on the revenues from milk products alone. No nomadic Fulani are, or have ever been, oriented towards the production of beef. Should the revenues from milk products drop too low to buy millet, the nomads are more likely to settle down for a while and cultivate a field then to treat their herds as a source of income from animal sales. Cattle are, of course, sold from time to time, but from the point of view of the herd manager, these sales are generally in response to large financial needs above and beyond subsistence, such as medical expenses, taxes, ceremonial expenses, clothing, and lastly cooking utensils and manufactured items.

2) The second major point is that the nomads and the sedentary peoples among whom they move are, in a certain sense, a luxury for one another. The nomad economy does depend absolutely on the products of the agricultural economy, but the nomads are such a small minority of the population that the amount of millet they obtain from the farmers is negligible when compared to their total harvest. In exchange, the milk products that the farmers buy or trade from the nomads are luxuries in their own diet. Only the richest of villagers, such as shop-owners, traders or civil servants would be likely to buy milk or butter every day. The interdependence of these peoples is thus not at all like that with which we are familiar in a modern, market economy.

Let us now look at the nomadic modes of life and production in a little more detail. Though an outsider, seeing vast herds of cattle being driven across the plain, might think that the Fulani must be rich, this is not really the case, as a look at the productive system will indicate. The average nomad household head manages a herd of ten to 50 cattle (Dupire, 1962:128). The average number of people in a nomadic household is, according to one census, 5.1 (Stenning, 1959:160). Let us take for a test case a hypothetical family of six, with a herd of

sixty cows. By nomadic standards, such a family is well off. How do they actually fare if they try to live off the produce of their herds? We have some solid basis for an answer in a very interesting recent study on herd economy by two Swedes (Dahl and Hjort, 1976). Summarizing other studies from many sources, they estimate the human milk requirements if people are to live on milk alone. Finally, they calculate the optimum percentages of different categories of animals (e.g. milk cows, heifers, bulls, etc.) for a healthily balanced herd. From these figures they can calculate the number of milk cows it would take to feed a family of six and thus the total optimum herd size. The results are surprising and thereby instructive.

In the best season, the height of the rains, Dahl and Hjort say that a milking cow can give two liters of milk per day for human consumption. Under these favorable circumstances, "nine milk-giving cows are well sufficient to provide for the requirements of the reference family of six persons ... The total herd necessary to contain sufficient lactating cows would be in all sixty cattle (158)", given the previous assumptions about distribution of animals in the herd. So far so good -- the Wo'daa'be are right on target. It also turns out that these nomads have the optimum percentage of milk cows as recommended

by Dahl and Hjort, though the structure of their herds differs in other categories. Dupire cites a study done near Nguigmi which revealed that 29.82 percent of the Wo'daa'be cows were milk cows, and Dahl and Hjort recommend 29.5 percent (Dupire, 1962:109; Dahl and Hjort, 1976:157). But what if the cows don't give two liters of milk per day? In my own experience, hardly any cows gave that much, and though Dupire does not say how much milk the Wo'daa'be cattle give, we can calculate an approximate amount on the basis of how much butter the women make. Speaking of the dry season, she says that a woman can get about 250 grams of butter per day from the combined milk of four cows. Assuming a butterfat content of about five percent, this means that those four cows are giving a combined total of about five liters, or 1.25 l. per cow (Dupire, 1962:127).

Dahl and Hjort calculate (p. 158) that if the average yield per lactating cow is 1.5 l., then to feed a family of six a total herd size of 73 animals is needed. They continue:

> In the dry season, small amounts of milk are produced by a small number of animals. At the height of the period only four percent of the total herd are lactating; i.e. in February, when fourteen percent of the fertile cows are lactating, and when individual yields are low, maybe not more than 0.7 kg per cow. A herd of the required size for a family of five adult equivalents would need to consist of 593 animals! (ibid.)

We can see from these calculations, that it is clearly outside the range of possibility for the vast majority of nomadic households to subsist entirely on their milk production. While a well-off household can live on milk alone during the height of the rainy season, this is possible for but a few months of the year and the rest of the time food must be obtained in some other way. That way, as we have seen, is the exchange of milk products for money or directly for millet. Dahl and Hjort point out, in this context, a fact that we shall return to later on, namely that a family of six could not possibly manage a herd of around 600 animals. There are upper as well as lower limits on the size of herds in relation to family size and the ecology of the region.

It should now be clear why the Fulani nomad economy can function only when there is trade for a goodly portion of the year with agricultural peoples. But why, it is often asked, don't the nomads settle down? Sedentarization of nomads is often seen as the necessary first step in improving their lot and in developing their economy, but the obstacles to sedentarization are wrongly and unfortunately perceived as residing in the nomads' love of wandering, in their backwardness and unwillingness to break with ancient traditions, and in their ornery,

uncooperative character. The issue here is not whether these phrases describe the nomads, but whether they explain their behavior. It is actually my impression that nomads do not especially love wandering per se, but they do appreciate what wandering does for them: basically, it enables them to feed their cattle. Why couldn't they feed their cattle by staying in one place? Because cattle need a very extensive area to graze in, while at the same time, in those areas where permanent settlement is possible, there is still competition for land from agriculturalists. This is, in a sense, as it should be, because in a fertile area agriculture is far more efficient than raising animals is as a way of converting the sun's energy into energy our bodies can use.

The crucial importance of cattle (and other livestock) is that they can extract energy from environments where farming cannot be effectively practiced, and this is precisely the fact about many regions of the sahel. What prevents farming from being an effective use of human energy in much of the sahel is not just lack of rain, but also the impossibility of knowing when and where rain will fall. Ponds form and grasses spring up when it does rain, but sufficient rain for a good crop of grass, let alone a good crop of millet, may not fall in the same place the following year. Livestock, however, can be led

to the grasses wherever they are; in addition, the animals' ability to move rapidly makes it possible for them to get to the grass at the time when it is the most nourishing and they can thus make its energy available for human consumption. An important side-effect of this process is that the cattle are being led away from ripening fields in the agricultural areas, and because they are well fed there may well be sufficient milk to support the herdman's entire household without recourse to millet.

As the ponds and waterholes in the non-agricultural areas dry up after the end of the rains, the herdmen are forced to bring their cattle back to regions of permanent settlement. Even if untouched pastures remain, they cannot be used if there is not water nearby. This is almost always a very tense time of year because the fields may not yet be harvested by the time the nomads come back and fights often break out over damage done to fields by cattle. Once the harvest is in, however, the cattle become a positive advantage in these areas: they can scavenge the fields and eat up the millet stalks, and they can manure the fields and thus help to ensure better crops next year for the farmers. Thus, during the dry season, the presence of the nomads' cattle is generally a boon to

the sedentary peoples, and those who have a little surplus millet can enrich their diet by trading millet for milk and butter.

We have just seen that the existence of a short, uncertain rainy season and a long dry season is what makes the raising of cattle an efficient way of exploiting the environment. It is these same factors, however, which make life hard for herders, both nomadic and sedentary. The dry season is an unpleasantly hot time for everybody in the sahel, but farmers have little work that must be done then and can pursue a variety of other occupations, such as weaving, carpentry, housebuilding, tailoring, or trading. But it is in this period that herdmen must do their most demanding and grueling work, watering the cattle and taking them to and from pastures of dry grass. Some Wo'daa'be have an ox that they use to draw water by attaching the end of the bucket-rope to a cinch around its belly and then driving it away from the well with the rope passing over a wooden pulley (Dupire, 1962:90). Most men, however, must do this work by hand, and the wells can be as deep as forty meters (ibid.). This is obviously hard work, but it is made even harder, as the dry season progresses, by two other factors: first, the length of time required to water the herd increases

because the amount of water in the well decreases. The person hauling the water gets a smaller amount each time he draws up the bucket, and he has to wait longer and longer between each haul for the water to seep into the bottom of the well. Thus, towards the end of the dry season, a man may easily spend night and day watering his cattle. Second, as the cattle eat up the grass in the vicinity of the well they have to be taken farther and farther away to get adequate food.

These inevitable difficulties and hardships of keeping a herd alive are among the factors that place upper limits on the number of animals a man can take care of and thereby they actually play an important role in the success of the nomadic way of adapting to the environment. To understand this point better, we need briefly to look at how land, water and animals are owned in nomadic Fulani society. Among all the nomadic peoples of the sahel it is generally felt that pastureland belongs to no one and that anyone, therefore, has a right to use it. At the same time, everyone recognizes the good sense of not pasturing cows near wells in the rainy season and thereby needlessly using up valuable dry season pasturage. In practice, however, conflicts can easily arise, for one group's rainy season pastureland might well be another's

dry season reserve and might need to be protected by various forms of dissuasion including physical force. Similarly, among nomads, natural sources of water such as streams, ponds, and water holes are not considered to belong to individuals or groups. In the rainy season pasture areas water can be found nearly everywhere and, except for major ceremonies, people travel in small groups, spreading out over the landscape and thereby taking maximum advantage of fresh grass as it becomes available. Wells, however, are an entirely different matter. A well is owned by the person or group that dug it or had it dug. In principle, people other than the well's owner(s) may not use its water without permission. During the dry season, the Fulani move in small circuits about the wells which they own. According to Dupire, the Wo'daa'be do not know how to construct wells themselves, so the members of a "fraction" will together put up the money to pay the Hausa to do it for them (1962:90). The need for well-ownership in order to obtain water, and the fact that someone is going to have to work hard in order to quench the thirst of a whole herd, are thus factors which help keep an upper limit to the size of herds and which, thereby, spread the cattle around as much as possible in the dry season. No one is going to go to the trouble of constructing

a well or trying to water his cattle in an area where the pasture is poor or where there is already too large a concentration of animals.

But, if in reality, the herds are unequal in size, (we saw that the average household herd ranged from ten to fifty animals, and there are a few households with a hundred or more animals), how then does this "spreading around" take place? It takes place through two major social patterns, which are found both among the nomads and among many semi-sedentary groups. On the one hand, individuals who are poor in cattle attach themselves to households that are better off; more exactly, these individuals do not separate themselves from those members of their family, such as fathers, uncles, brothers or cousins, who have a substantial number of animals. On the other hand, regardless of how many cattle a person owns, he rarely has them all in the same place but has a certain number of them loaned out in various arrangements in the herds of other people. By the same token, the cattle in a household head's herd are never all his in an absolute sense. Not only will some of the animals be on loan from other people, but also each member of his immediate family may own some of the animals he takes care of. It is quite possible for a man to be manager of a large herd and yet

be the actual owner of just a minority of the animals. For in Fulani society, anyone can own cattle, including women and seven-day-old children who have just received their names. Among nomadic Fulani, women and children are both like minors when it comes to actually disposing of their animals, for they normally have to make any transaction through the herd manager. On the other hand, the herd manager is limited in his freedom to do as he pleases with the herd. While it is customarily possible for him to sell a cow belonging to his wife or child for a family emergency, or to slaughter a family member's bull to honor a guest, he cannot do this frequently without drawing on his own property in fair proportion to the others, without suffering severe consequences, for owners of the cattle he managed would place them with other people if at all possible, and his children would desert him at the first opportunity. Let us take, for example, the case of the cattle a woman owns: in the early stages of her marriage, before it is clear whether or not she will stay with her husband or have children by him, she does not bring her cattle into his herd but leaves them with her father and/or brothers. These people benefit from the milk of those cows so long as they have the care of them. Thus, a husband can begin to benefit from cattle

his wife might own only when there is mutual trust between the partners and when the wife feels reasonably secure in her position.

The fact that many of the cows a man takes care of are not his own, and that many of his own cows may be in the herds of other men, contributes, to a wide dispersal of the cattle in both rainy and dry seasons and thus makes possible an effective utilization of the environment. There is another consequence of this practice that is worth mentioning now. Since a substantial proportion of the cattle a herdman takes care of are not his own, his attitude towards the animals is not properly one of ownership but of stewardship. John Aron Grayzel, in writing of the Fulani of Doukoloma in Mali, put it very well when he said that "For the Peul, cattle are capital, like stocks; something to be carefully watched and manipulated in the hope of accumulating sufficient wealth to live off the dividends (1976:28)," while "to the Bambara a herd of cattle is a savings account; a place to guard surplus funds for either special future outlays or unforeseen circumstances (ibid)." Thus for the Fulani, both nomadic and semi-sedentary, the herd manager is like the guardian of a trust. He and his family live off the dividends (i.e. the milk) of that trust, and he is thus very reluctant to

part with any of the dividend-producing stock. The Fulani, however, frequently sell bull calves. Since the Fulani are not at all oriented towards beef production, they see the raising of unnecessary males as useless expenditure of effort, and whenever possible they would like to use the money they get from selling a bull in order to buy a cow or heifer; but, since everybody has the same attitude, heifers and milk cows rarely come on the market. Thus, it doesn't pay to raise a bull or steer very long, and if expenses have to be met it is a young bull that will be sold. Such a sale would usually take place during the second or third year of the bull's life, because if sold earlier its mother's milk, which the people are using, might dry up prematurely.

Has the reader yet begun to wonder about the economic contribution of women in nomadic life and what their role in maintaining that life might be? If not, this is a significant reflection on our own prejudices and should alert us to the kinds of things we are likely to overlook when studying another culture in a development context.

The women play a key role in the economic life of the nomads because they are the ones who milk the cows, prepare the milk and butter for market, and then sell these products. Theoretically (that is, according to Fulani ideals) the woman is the full owner of the milk

she gets from cows that it is her right to milk, and she can dispose of the milk and the income from it in any way she wishes. In theory, too, the head of the household is supposed to be the sole provider of food for the family. In practice, however, both these ideals are contravened because of the overriding desire of both men and women to conserve their capital -- their animals. It is mainly through the women, then, that the nomadic Fulani become connected with the agricultural economy and are thereby enabled to live as pure nomads without having to practice agriculture themselves. While at first glance this work of the women might not seem very productive, it is not part of the "productive sector", it is clearly indispensable to the nomadic way of life and it is hard to imagine a more efficient way of distributing milk and butter under sahelian conditions.

Most of the energy women expend during the day goes into keeping the home going and brining up the children. The preparation of milk products for the market can be done concurrently with preparing the family's own food, and the actual selling, as with many women's occupations, can be done with children in tow or being carried on the back. There is really no adequate way of comparing the quantity or difficulty of two different kinds of work, but there is no doubt in my mind that women do somewhat

more work than men do, on the average. At the height of the dry season men are probably under greater physical stress than women ever are, however, except for the times when women are in "labor" itself. The woman really has complete responsibility for the domestic area of the camp -- the beds, the shelters, the hearth, and the cooking equipment. She packs and unpacks when the camp moves, she sets up the shelters and arranges the utensils in their places. She is responsible for getting water and firewood, and she often buys the millet for the main meals with her "butter-money". She milks the cows, makes butter, pounds millet into flour and cooks the staple dishes and sauces, and washes the bowls and utensils before the next meal. She washes clothes, weaves the mats that serve as mattresses and blankets, takes care of small children of both sexes and is the main educator of her girl children until they leave the home to live with their husbands. All this makes for a lot of work, and it is just as relentless in its demands as is taking care of cattle. Think, for example, of the common situation where a woman will have to go several miles every day to get water, and maybe more than once, with a newborn baby on her back and a three year old child tagging along behind who will have to be picked up and comforted, or waited for, etc. during the trip.

For the man, the reward of doing his job well is seeing his herd grow over the years. For the woman, the rewards are in the close bond she forms with her children that last for life, and in the measure of financial independence and pride she can get from properly handling the distribution of the milk products she controls. These two sources of well-being are interlocking in that, in order to obtain milk and feed her family, the woman has to have enough healthy cattle to work with. And for the man, having a growing herd is almost impossible without having a growing family as well. There are several reasons for this. The most basic one is that a man and a wife alone cannot manage a herd of cattle unassisted; if they have no children old enough to help them, then they must live in some kind of cooperative arrangement with other families, such as that of a father or older brother, and this means that they won't be fully independent and won't have full control of what happens to their herd. Second, one of the ways in which a young man obtains cattle is by gifts to his children from relatives. Strictly speaking, these are not his own cattle, but he can use them (and their offspring of course) for twenty years or more until the child in question is old enough to set up an independent household.

The important thing to remember here, when looking at the nomadic Fulani in a development context, is that the less visible women's sphere cannot be ignored. The women's activities appear to run more or less by themselves, totally independent of the men's activities, but that is only an appearance. The effect on the life of women, and thereby on the whole family as a productive unit, of such changes as greater orientation to beef production or commercial milk-marketing schemes, would have to be carefully thought through and preferably discussed with all parties before being tried.

Behind the male reward mentioned above of seeing one's herd grow over the years lies a more general and ultimate reward, that of being on a footing of dignity and equality with respect to one's peers and of having some sense of control over one's destiny. The nomadic Fulani, as well as most of the semi-sedentary ones, seem to be very anarchic in their political organization. Their chiefs (ar'do, pl. ar'be, meaning leaders) act as guides, arbitrators, and spokesmen for extended family groups that tend to move about more or less together. These groups range from a few households to as many as fifty, but rarely more (Dupire, 1962:289). These chiefs have no real powers of coercion over their followers, nor

can they make binding agreements on their behalf. Though they usually have some hereditary right to rule, it is really only through demonstration of good qualities like intelligence, generosity, and patience, combined with persuasive eloquence, that they can actually get their followers to do as they say. This weakness of the chiefs, and the small size of their constituencies, can be thought of in part as the consequence of the Fulani value of independence we have just mentioned. And the anarchic political organization indeed makes it difficult for a country to administer the Fulani or negotiate any kind of consistent economic, health, or educational program with them. But, it is important to understand that both Fulani political organization and their love of independence contribute significantly to the Fulani ability to take advantage of the economic resources of the sahel. People who were brought up to always be told what to do, or who didn't feel comfortable unless lots of people were always nearby, would not make good herders. We have seen that the land is best utilized when people and cattle spread out to the maximum degree, and for this to happen people have to be relatively independent of one another, able to make their own decisions and take their own risks, and like being in that situation.

Historically, however, optimum utilization of the land has not always been people's prime consideration. In fact, I would argue that it is only during the colonial and modern periods that such economic factors have been able to have free play. This idea is supported by the observation that most of the nomadic Fulani are newcomers to the regions they are found in today. (Dupire, 1962:51; Horowitz, 1972:106). It is probable that one of the reasons they have been able to infiltrate zones that were traditionally controlled by the Tuareg (cf. Dupire, 1962:91-92) is that the once powerful Tuareg society can no longer control its own territory by force of arms, nor frighten small bands of herders with the threat of violently robbing their cattle. In general, the dangers of violence and cattle theft, which had formerly been major influences on the ecological adaptation of sahelian peoples, have been almost negligible in most areas for two to four generations. The effect of those dangers in the past would have been to greatly limit freedom of movement, to counteract the extreme tendencies to split up into small camps, and to slow down penetration into unexploited areas of the sahel. All of these effects together probably made the growth rate of both human and bovine populations lower than it is today. Another conseque

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of the violence of the precolonial period, however, was that some semi-sedentary Fulani took better care of their cattle then than they do today. As we shall see, one of the ways the semi-sedentary life-style differs from the nomadic one is that constant surveillance of the cattle is not necessary for the former because much of the year they are in "home territory." The nomads, on the other hand, really have no home territory and must therefore be on their guard more of the time.

There are, as we have seen, a number of constants that are as true for the non-nomadic Fulani as they are for the nomads. In particular, the points to remember are the orientation towards milk-production rather than beef production; the long dry season and therefore, the impossibility of living on milk alone all year round; finally, the need for mobility so as to be able to lead herds to the right places at the right times for optimal exploitation of the sahel environment. There are also many similarities in attitudes and social institutions. For our purposes, among the most important to remember are the belief that nobody owns pastureland and natural water holes or ponds, while wells are owned by those who dig them or commission them. Herds are constituted in very much the same fashion, so that the herd managed by

the household head in fact contains many animals that are not his own, and he, in turn, will have a part of his animals scattered in the herds of his friends and relatives. Other similarities will be mentioned as we come to them.

We have seen that the non-nomadic Fulani make up the vast majority of the total Fulani population, since of the total of nine million or more, about 100,000 are pure nomads. The term "non-nomadic" of course covers too many different ways of life to deal with conveniently at the same time, so some way of classifying the different groups is necessary. Scholars writing on the Fulani have classified the various groups according to a wide variety of criteria. We passed over some of these in the historical review, but their main value for our purposes here is simple familiarity: it is useful to have a general idea of what an author is talking about when he mentions the Peuls, the Toucouleur, or the Bororo.

There actually is no one criterion that makes the most sense for classifying the Fulani with a view to studying their possibilities for economic development. Therefore, I will classify the non-nomadic Fulani according to both social and geographic criteria into three main groups: 1) The "semi-sedentary", which

includes all Fulani who farm and for whom cattle-herding is also important, regardless of how much they actually move around; 2) the "sedentary", which includes Fulani who farm or pursue other occupations, and who do not do a significant amount of cattle herding; 3) the religious elites, who form a class apart and who are supported by Fulani (and to some extent other) Moslems from all walks of life. Many authorities make a distinction between semi-nomadic and semi-sedentary, in order to suggest differing degrees of nomadisation, but I don't believe that that is a very significant difference, and there is no obvious place to draw the line between the two categories. Within my category of semi-sedentary Fulani there is, however, a significant geographical difference in that some of these Fulani, like the nomads, pasture their herds in dry pastures around wells in the dry season, while others during this season send their cattle to graze on the "burgu" grasses created by the flooding of the inland river deltas, especially that of the Niger. In what follows, I will for the most part, treat both major modes of semi-sedentary life together, and will point out regional and ecological variants as we go along. I will not discuss the sedentary Fulani in any detail, since their concerns and way of life fall, for the most part,

outside the scope of this essay. I intend to highlight the religious elites, however, because I believe that religion is potentially the most powerful single force operating in Fulani life today. It is certainly the force that is most likely to mobilize people for action, whether it be for good or ill.

Of the semi-sedentary Fulani we will be discussing, the vast majority feed their cattle in the dry season on the standing hay around wells, but a significant minority utilize the burgu of the deltas. Unfortunately, it is almost impossible to estimate how many Fulani utilize the burgu. The main reason is that the actual number of herdmen bringing the cattle into the burgu is but a small proportion of the population that depends on those cattle. If we rely on figures for the number of cattle using the burgu, however, and divide that figure by the approximate number of cattle per person among the Fulani in that general area, we can at least get a good idea of the order of magnitude of the population with which we are dealing. According to a study directed by the geographer Jean Gallais for the government of Mali in 1972, the number of cattle grazing on the burgu of the Niger delta in Mali in 1970 was 1,120,000 head, of which 630,000 came from the delta region and 490,000 came from neighboring regions (Rep. du

Mali, 1972, "Rapport de Synthese": 66-67). Of course many of the cattle do not belong to Fulani, but most of them are herded by them. A significant minority are owned and herded by Tuaregs. If we take as a rough guess, then, that 1,000,000 of these cattle are being used by Fulani (granting that some cattle are actually owned by members of other ethnic groups) and if we estimate that the number of cattle per person among the Fulani is about five, then we get a figure of about 200,000 Fulani whose life-way depends on use of the burgu in Mali. In Senegal, the number of people using the Senegal river delta is much smaller. One study done in 1965 indicated that the number of cattle in the delta amounted to 46,678 (Sow, 1965:25). General population figures suggest that the same number of cattle per person holds here as in Mali, so we can infer that about 9,000 or 10,000 Fulani graze their cattle on the flood plains of the Senegal river.

Using the best figures available concerning the states of West Africa, I calculate the total "semi-sedentary" Fulani population to be about 3,018,143, including the 210,000 users of the burgu-grasses of the river deltas. The number of Fulani following the sedentary life-style amounts to nearly four million, mostly in northern Nigeria. To this figure we should add most of the Fulani population

of Guinea, c. 1.5 million, since few Fulani there still live a pastoral way of life. Though the Toucouleur of Senegal and Mauritania do not define themselves as Fulani, they speak the same language; their lifestyle is definitely sedentary also. If we add in their population of 512,000, this would bring the total number of sedentary Fulani and Fulani speakers to approximately six million persons.

It is clear from these figures that from half to two-thirds of the Fula speaking peoples (depending on how you count the Fulani of Guinea) are sedentary in their way of life. Of the rest, the vast majority follow variants of the semi-sedentary life-style that I shall now describe.

Two major features distinguish the semi-sedentary from the nomadic Fulani: the practice of agriculture and the practice of transhumance. The necessity for transhumance arises really as a logical consequence of combining agriculture with pastoralism, but we will briefly discuss transhumance first since it is a term which has been used with different meanings by various authors and thus lends itself to confusion. In general, British authors have used the term transhumance to refer to all movements of people with their herds from one pasture area to another, while the French writers have restricted the meaning of the term to long-distance herd movements during the rainy season.

I will be using the term with a slightly more specialized meaning, namely the long distance movement of a herd in the rainy season under the guidance of a small number of male herders. Transhumance, in this definition, necessarily entails the seasonal splitting up of families and herds, with one part going on transhumance, the other part staying at or near "home".

During the rainy season, both the nomads and the transhumant herdmen from the semi-sedentary groups are moving about in the pastures of the sahel with their cattle. It is during this season also that both these groups take their herds to salt licks or salt earth areas, which are places where, by licking or actually eating the ground, the cattle can get a supply of many necessary minerals that are lacking in their usual diet. Both the nomads and the transhumant herdmen have an abundance of milk, but while the nomads use this to feed their whole families and to exchange for things they need, the herdmen cannot do this because they don't have women with them. The herdmen milk the cows for their own consumption, of course, but they do not make soured milk or butter for sale. In fact, the Jelgobe herders whom I accompanied on a transhumance trek in 1968 explained the non-success of our attempt to get milk to sour properly

with the remark that only women really know how to do this (see Riesman, 1977:64). It is possible that this is an economic loss for the semi-sedentary Fulani. The bulk of the people are cut off from their cattle at the very time when their cattle are most productive. On the other hand, the milk is not really going to waste, for it feeds the calves which would otherwise be deprived of some of that milk when taken by humans. The semi-sedentary people who stay at home are not entirely without milk, for they do keep a few milk cows and their calves with them. This system does not give people an abundance of milk, however, and it may be somewhat detrimental to the health of the cattle. In the Djibo area of Upper Volta, some families would send the cows on transhumance in two or more shifts, so that all the cattle would benefit from the salt cure and from the rich pastures, but due to a decrease in the number of young men willing to undertake this trek a considerable number of cattle every year do not get to go on transhumance. The Fulani all agree that this is not good for the health of the animals. The team of ecologists of the Malian-Dutch project "Primary Production Sahel" note in their analysis of a herd on transhumance from the village of Diafarabe (in the Niger delta) that the cattle that do not go on transhumance, "when

they rejoin the herd at the beginning of the dry season... are in a worse condition than the other cattle. Most probably this adversely affects both birth rate and calf mortality (Bremen et al., 1978:14)."

In general, the distance covered during the rainy season by the transhumant herdmen is much greater than that covered by the nomads. For example, we can see from the maps published by Dupire (1962: p.75, and facing p.80) and by Stenning (1959:93) that the seasonal movements of many nomadic groups are on the order of 50 to 80 kilometers each way, and that very few are greater than 100 km each way. The people of Diafarabe, on the other hand, send their cattle into the sahel region of Mauritania during the rainy season, and then deeper into the Niger delta during the dry season, for a total distance of over 1,000 km (Bremen et al., op. cit.:6). The Fulani of Doukoloma, on the Bani river southeast of Segou, send their herds a total of about 500 km round trip during the year's transhumance (see Grayzel, op. cit.:15-22). John Grayzel did not, however, have the impression that the transhumance was more beneficial to the cattle than staying at home, though had the cattle all stayed home there would not have been enough grass for them. He writes, "The Peuls are more successful [than the Bambara]

not because their animals migrate annually, but because they are more concerned about their animals (1976:30)."

The population of semi-sedentary Fulani is so large, and they live in such a variety of ecological situations, that it is difficult to say anything that would be true of all of them. One very general point can be made, however, that in the rainy season the herders tend to take the cattle to regions which cannot be grazed during the dry season due to lack of surface water. The reasons why some groups take their herds long distances, while others, such as the Jelgobe I studied, do not move very far, very likely are as much historical as they are ecological or economic. This is particularly true of the Fulani groups which make use of the burgu, either extensively or to pass through it. When the Niger is in flood, it is important to be able to get out of the delta and onto the bank one wants to be on in time, and one has to know the cattle paths (burti) and where they go. Not only that, the whole delta region has a set of grazing regulations laid down over 150 years ago by Sheku Amadu, the founder of the Fulani empire of Macina. This set of regulations, which still has a certain force today, gave precedence to specific Fulani groups in designated areas, fixed a rate of toll to be levied on cattle belonging to

foreign groups, and set up herding schedules such that the arrival of different herds on the scene would be staggered. And all of this was coordinated with a setting up of cattle paths and even overnight stopping places in such a way as to permit millet farming and particularly rice farming to go on at the same time (Gallais, 1975:357-362). The burgu is unlike any other pastoral region in Africa; it is certainly not an area that nomads can wander around in as is the case with the steppe and savannah. Not only is access restricted, as we have just seen, but also each Fulani village within the delta maintains a pasture area for its "dumti"--non-transhumant cattle -- that is absolutely forbidden to foreign cattle. This pasture is called the "harrima" (Gallais, 1975:359). This sketch of the system, brief as it is, at least gives an idea of the complexity of the arrangements, and we can see that for a Fulani group to make effective use of these pastures and cattle paths it would have to have deep, historical connections with specific peoples and places of the area. I have no first hand knowledge of the Niger delta myself, and there are almost no published studies of specific Fulani groups in Mali which show how and why they use the delta as they do. Looked at in the context of the mode of subsistence of the semi-

sedentary Fulani, the burgu is a very effective variation of the normal, dry-season pasturage system. It is both more dependable and usually more nourishing for the cattle than the method used by the majority of the Fulani of pasturing the cows on standing hay in the vicinity of wells. Because of expanding rice cultivation, however, its days may be numbered as a privileged area for pastoralists.

We have discussed transhumance among the semi-sedentary Fulani, and the ways in which this practice resembles and differs from the rainy season movements of the nomadic Fulani. Now we must look at what the rest of the people are doing during this time, and how they are organized. Their major pre-occupation, of course, is the cultivation of their millet fields; this work, in addition, must be combined, or juggled, with finding adequate pasture for the cattle if they have not gone on transhumance and at the same time with keeping those cattle out of the ripening fields. This is precisely the situation of the Fulani I studied, and a brief description of the major features of their ecology and way of life can be taken to exemplify how the majority of the semi-sedentary Fulani live, regardless of their actual location. For these people, as for the nomads, millet is the staple of their diet, but rather than buy it or trade for it, they grow

it themselves. We shall try to analyze the reasons for this. To combine the operations of cultivating fields and herding animals poses problems for the people that the nomads do not have. First, as we have seen, by sending some or most of his cattle on transhumance, the herd manager deprives himself of the benefits of the herd in the very season when milk is most abundant. Second, whether the herd manager retains some or all of his cattle close by, he has the problem of keeping those cattle, as well as those of other people, out of the ripening fields. Third, the protection of the fields and the transhumance of the cattle both require labor, which reduces the labor force that can be used on the fields. The device the Jelgobe use to deal with these problems is also used in most areas of the sahel where the Fulani are the majority of the local population, particularly the northeastern parts of Upper Volta, the western parts of Niger, and the southeastern parts of Mali. This device consists in building a fence (hoggo) of thorny branches around the fields so that the cattle can be left to wander untended in the neighboring bush. This device cannot be used in areas where agricultural peoples are the dominant population because these people, not having significant herds, do not have any reason to

enclose their fields and therefore there must always be herdmen to keep the animals out of fields.

Although this system does help the manpower problem, other difficulties can arise. Perhaps the most serious one is that of the location of the family's field in the first place. There are good reasons to have the field located near the dry season wells because then, in the dry season, the cattle can manure those fields while they are coming in from the bush to drink water at the wells. In the Djibo area of Upper Volta, families would set up their dry season huts in the middle of their own fields (completely bare by November or December) so that the cows, bedding down for the night around the huts, would leave their dung there. But in that case, the immediate bush nearby is also the dry season pasture, and there is danger of shortage of grass if all the cattle that stay there in the dry season stay there during the rains as well. What people whose fields were near the wells actually did when the rains came, was to split their herd and to send a large part of it to spend the rainy season with relatives whose fields were in the bush, far away from the wells. But those whose fields are far out in the bush have another problem to face. During the rainy season the situation is excellent,

for the cattle are spread out thinly and have ample and rich pastures where they can graze with little supervision. In addition, while the men are working in their field they can eat the remains of the previous year's harvest stored in a bin made of wood and thatch and raised on stilts. But when the harvest is in, and the surface water dries up, the people have to move away. There is little opportunity for the cattle to manure the field, so the productivity will decline and eventually a new field will have to be cleared whereas fields around wells are productive year after year. Worst of all, perhaps, when the family moves to the wells that it shares with other relatives, it is no longer near its millet supply, and family members must make constant trips back to the storage bin (two or more times per week, even using a donkey, as hardly any Fulani have carts) in order to get grain to feed themselves.

What is the contribution of the women among the semi-sedentary Fulani? Their domestic role is just the same as among the nomads: they milk the cows and prepare milk products, they build and take down the houses, they prepare all the daily meals, including the getting of water and firewood, they wash dishes and clothes, and they take care of the children. They do not help out with the hoeing of

millet, nor do they make gardens of their own (but a few cultivate a little patch of flax whose fibers they use to make the string that holds together their woven straw bed mats). They spin a little cotton into thread and either sell the thread or commission a weaver to make cloth from it, and they weave beautiful straw mats in a variety of sizes and designs for use as prayer-mats, bed-mats, bed-canopy mats, or to make a house. Conspicuous by its absence in this list of women's work is the selling of milk and butter. We saw in the case of the nomads that the selling of milk and butter was essential to the nomadic subsistance economy, but that kind of trade is unnecessary for the semi-sedentary Fulani because they have their own supply of millet. The markets are very few and far between in this part of the sahel, so it would be almost impossible for women to go to them on a regular basis. But they do go occasionally and they usually sell either soap, which they have made with the butter from milk of their cows, or mats of the type described above. The purpose of these sales is not family subsistence, however, but to obtain personal spending money that will be used for almost anything, from alms to clothing, gifts and jewelry.

Words are very tricky; they can tangle our thoughts up dangerously. I spoke above of the non-necessity of

trading milk and butter for millet. That is perfectly true, but I think its implications are all wrong. It is not because the Fulani have millet that they do not need to trade for it -- rather it is because there is no opportunity to trade for it, that they have to grow it themselves. Even this formulation is only part of the story, as we shall see, but it is much closer to the Fulani perspective. The semi-sedentary Fulani think of themselves as cattle people, despite the fact that income from their herds plays a fairly small role in their economy, and most of them resent having to cultivate millet fields. It would be good to remind ourselves at this point of an important fact brought out earlier: we saw that living on milk products alone was not possible under sahelian conditions and that therefore, somebody had to be cultivating grain if cattle-herding people were to thrive. The question is, who is that somebody going to be? In the case of the nomads, we found that they tended to be relative newcomers in their areas and that they formed a very small proportion of the total population of the region they move about in. I suspect that there is a threshold above which that proportion must not rise if the nomadic way of life is to be sustained. I also suspect, though I lack the data to make the

calculation, that the proportion of transhumant herdmen in relation to those they leave behind would be of the same order. The next question is, why aren't there enough non-Fulani people around with whom the Fulani could trade? There are a number of factors involved here, of which perhaps the most important is that the Fulani have been very successful both in increasing their herds and in reproducing themselves. I am not impressed by the studies that show pastoralists as reproducing less fast than agriculturalists. This may be the case today, but it is important to remember that in precolonial times the pastoralists, because of better diet and more sanitary living conditions, may well have been augmenting faster than non-pastoralists. A related fact is that in the precolonial period there were non-Fulani populations with whom the Fulani traded -- by force. In all those areas where the Fulani are today the dominant majority they were, in the nineteenth century, the masters of slaves or serfs (maccu'be and riimaay'be) who did all their agricultural work. These slaves were both the descendants of local conquered people and the descendants of people captured in foreign wars or bought at a slave market. This historical situation is one of the reasons why figures concerning Fulani population are so uncertain. Very

often in a national census the Fulani and the riimaay'be both are added into the Fulani population for that country, and we often just don't know whether this has, in fact, been done and if so, what the proportion of Fulani to riimaay'be is. Jean Gallais, for instance, in an essay discussing the Mopti region of Mali, says that the Peul account for 38 percent of that region's population. In the next sentence he says that the true Peul amount only to about 20 percent of the population, or a little more than half of the percentage reported in the census (1975:355). Similarly, I found in Djibo that 72 percent of the population was Peul, but that only 44 percent were actually Fulani. The national census does not make this breakdown. (See Riesman, 1977:18).

It is often suggested that the sedentarization of nomads is an indication of the failure of nomadism as a way of life. While there is no doubt that mobility is essential to successful exploitation of the sahel environment, I would argue that the semi-sedentary way of life is actually the product of a highly successful nomadism which rapidly increased numbers of people and cattle, and gave the nomads enough military power to drive out some and enslave others of the peoples among whom they lived. (See Riesman, 1977, pp. 43-45 for discussion of this idea

in relation to the Djibo region.) Derrick Stenning has also suggested that semi-sedentarism might be the result of success rather than failure, citing the example of the Jos Plateau Fulani (1959:8).

The semi-sedentary Fulani we are talking about, then, have been living through a period of drastic change in their way of life since the inception of the colonial period. How drastic this change has been is not obvious to the visitor because Fulani camps tend to have almost no western goods or other evidences of the "influence" of Western civilization. The fact that, in general, the Fulani are using traditional African technology can easily lull one into thinking that they are living in an age-old, traditional life pattern. Actually, for the past two or three generations, they have been evolving an unprecedented life pattern whose major new parameters, in order of appearance, are impossibility of military action and organization, impossibility of getting millet supplies from the work of slaves or serfs, and progressive absorption of the whole economy into the world economic system.

It may seem that I have been emphasizing the difficulties and problems the semi-sedentary Fulani have in combining agriculture and cattle-raising. The reader may

wonder at this point why they bother at all. I will return to the problems again, but would like to say a bit now about the advantages of this way of life. It seems to me that there are significant advantages in three spheres: 1) nutrition and health, 2) effective use of labor force, and 3) security. Let us look at each of these briefly. There is an incontestable advantage to having a supply of animal protein. Most West African children get almost no protein except what comes through their mother's milk, but semi-sedentary Fulani children do get milk, sometimes all they can drink, for three to five months of the year, since whether the cattle go on transhumance or not, there are always milk cows left behind (note also that, in order for there always to be lactating cows, those animals must come from a much larger herd). Having cattle (as well as sheep and goats which these Fulani also keep) means, in addition, that there are occasions when meat is eaten. Fulani do not kill their animals, as a rule, just to eat, but generally either for some ceremony or because the animal is dying anyway. Thus, though people do not get meat on a regular basis, there are occasionally times when they do eat it. When cows are being slaughtered because of being near death from disease, there can even be an abundance of meat. Along

with the definite advantage of better diet, there may be a marginal advantage of more sanitary village conditions, for the simple reasons that the huts in semi-sedentary hamlets are more spread out than is the case with purely agricultural peoples, and that the people move a few times a year, which gives climatic and biological factors the time to dispose of accumulated refuse before the return of the seasons brings the inhabitants back again.

The effective use of the labor force can be seen in the fact that for semi-sedentary Fulani there is hard work to be done all year long. We saw that for the nomads, the hard time of the year is the dry season, while for the farmers it is the rainy season; the semi-sedentary people can be thought of as simply combining these two work systems. They are perhaps, then, exploiting the sahel environment in close to an ideal way. It is significant that the Fulani contribution to the annual labor exodus to Ghana and the Ivory Coast is extremely low. The Mossi, for example, as is well known, have a very large proportion of their young men working away from home. Delgado found in his study of one Mossi village that nearly half its income came from remittances by family members living away from home (1977:14); over half (54%) of the households had no males between the

ages of 18 and 30, and only five out of 29 households had more than one male between 18 and 39 present (op. cit., p. 12). Fulani households surveyed in the same area had an average of two males between 15 and 60 as permanent residents (op. cit.:19). The Fulani way of life can thus be seen to be supporting a vigorous and growing population in the sahel by keeping most of the work force at home and with a minimum of support from sources outside the region.

The security which the Fulani way of life brings has to be thought of in relation to sahelian conditions. If we keep in mind that the sahel is a zone where the rainfall averages from 200 to 500 millimeters a year and where that rainfall is unpredictable both as to time and place, we can see in what sense there is a certain insecurity inherent in living in the sahel, an insecurity that is much reduced in sudanic zones. In the northern parts of the sahel agriculture is not really possible at all, and in the southern parts it is always somewhat risky. Let me re-emphasize a point I made in connection with the nomads; if there were little risk inherent in the environment there would be no question but that agriculture would be a more efficient way of getting energy than cattle-herding is. It is precisely the

riskiness of the agricultural venture that makes raising animals an efficient way of exploiting this environmental niche. What raising animals does, for those who grow crops in the sahel, is give them mobility so that they can take immediate advantage of a better-favored micro-region if their own should have bad luck one year, and it also gives them a back up source of capital which they can trade for grain if all else fails. People without cattle must live on last year's grain while they are cultivating what they hope will be the next harvest; herders, however, are not tied down to that grain supply since, if necessary, they can live on the milk of their cattle wherever they are while they do the cultivating.

Before giving a sketch of political organization among the semi-sedentary Fulani, let me briefly discuss a small group of semi-sedentary Fulani whose ecological situation is a bit different. These are people living in sudanic rather than in sahelian regions, and living as small enclaves, sometimes individual families, among populations of other ethnic groups. Fulani in this type of situation can be found in nearly every West African country. In some places they eventually lose the Fulani language, but they do continue to specialize in herding cattle. Little is known about these small enclaves, but a few good

studies have recently been done and the results suggest that each location is different enough from the others to preclude useful generalization (cf. Grayzel, 1977; Delgado, 1977). If we keep in mind the factors previously discussed that affect the nomadic and semi-sedentary ways of adapting to the environment, we could say that the Fulani of Doukoloma studied by Grayzel are, in a way, nomads who have struck it rich enough to settle down (similarly to the Jos Plateau Fulani mentioned by Stenning). They do plant fields, and they do send the cattle on long transhumances, as we have seen, but they are well off enough to pay the Bambara among whom they live to do the hard work for them. If they became much more numerous, however, this might no longer be possible (see Grayzel, 1977:75-78). The Fulani living among the Mossi near Tenkodogo do not seem quite so fortunate. Perhaps because the environment is harder on cattle, they are not as rich as the Doukoloma Fulani and they therefore have to cultivate their own fields. At the same time, since the Mossi do not fence their fields, men are needed as full-time cattle herders so that fewer family members are available to work at hoeing (Mossi women hoe, while Fulani women do not). Another difference between the Fulani enclaves among the Bambara, and among the Mossi,

is that the former do not as a rule herd Bambara cattle, while the latter herd all the cattle belonging to the Mossi and, in fact, are enabled to survive as pastoralists because about 70 percent of the cattle they herd are owned by Mossi (Delgado, 1977:34).

With the exception of enclaves like the ones just described, the semi-sedentary Fulani tend to have stronger and larger political organizations than do the nomads. Most importantly, while the nomad groups, together with their chiefs, are often in the position of guests on foreign soil and thus subject to the chiefs of the dominant groups of the region (these may sometimes be sedentary or semi-sedentary Fulani), the semi-sedentary groups are usually the masters of their own area and their chiefs are above those of the other ethnic groups of their territory. Nonetheless, the anarchic tendencies mentioned before are very much present in these chiefdoms; here, as with the nomads, individual ownership of cattle makes it relatively easy for a family to head for other parts, such as distant relatives in another country, if the situation at home becomes difficult for any reason. The relation between a chief and his followers is in some ways like that of a President and the congress of the United States. Chiefs may differ in character and

charisma, as some will try to browbeat their followers, while others will try to persuade them by appealing to precedent, morality, self-interest, or whatever, but in any case they cannot really order them to do anything. They have to have their followers' consent. The only people who can be ordered around are slaves and young children, and adult Fulani are neither. To order someone to do something is to humiliate him. Fulani generally make every effort to avoid humiliating a person. At the same time, the Fulani hignly respect the office of chief, and willingly give their allegiance to a person who fills that office with dignity, intelligence and respect for others.

In the context of working for economic and social development the implications of this political structure are that 1) one must make initiatives through the channels of the local system since, if one tries to bypass it, botn chiefs and followers may feel offended that they have not been treated with respect. 2) At the same time, the system is not a clear authority hierarchy like a bureaucracy where directives at one level regularly lead to execution at another. This means that "grass roots" work is absolutely necessary; discussions about projects must be held not only with chiefs, but also

with all the people who might be affected. 3) Finally, opposition to a project by a chief does not mean it is doomed. All political societies have factions and disaffected people. A group might form a united front of opposition if the members sensed their chief was insulted, but if they thought he had been treated with respect they would feel quite free to think for themselves and make up their own minds about how to deal with some situation.

If asked whether they believe in Allah and his prophet Mohammed, all Fulani today would say that they do. It is possible that here and there a handful of animists remains, but my survey of the literature on the Fulani suggests that while some Fulani have only recently become Muslims, and while there is a good deal of variation in the significance of Islam, both to specific groups and to individuals within groups, being a Muslim is today part of the ethnic identity of being Fulani. What is the role of Islam likely to be in Fulani development? One mistake outsiders often make when looking at non-Western peoples is to think of them as "in the grip of" their traditions, or as "dictated to" by their religion. It is true that religion is often conservative, acting as a brake on change, but if

we look at this phenomenon sociologically we can see that there are good reasons for this. One fact of particular importance for understanding development problems is that religion or tradition often backs up practices that have long-range beneficial consequences for the group, but which may seem "irrational" or "counter-productive" in the short term. A hypothetical, but fairly typical, example would be a tribe which refuses to use the wood from, or to farm in a "sacred" forest. An outsider might think that land was going to waste, while on closer inspection of the situation he would find that the village's source of water is located there, and that many unusual medical plants are found there and would eventually disappear if people gave in to the temptation to exploit the land in a more obvious, rational way.

We shall come back to the question of Fulani "fatalism" and the role of Islam in this. Here I want to emphasize the dynamic role of Islam in Fulani society, and the important functions of the religious elites (called "Marabouts" in French-speaking countries, "Mallams" in English-speaking ones). A glance back over African history of the past 200 years shows that wherever Fulani are masters of the region they live in (with the exception of Djibo in Upper Volta) it was a holy war (jihad) that

enabled them to achieve sufficient organizational structure and unity of purpose to take over those territories. Prior to the holy wars, which began in the late eighteenth and early nineteenth centuries, the Fulani nearly everywhere had been subject peoples in lands ruled by other ethnic groups. This accomplishment is all the more impressive given what we know about the anarchic tendencies in Fulani political organization. The powerful, unifying force of Islam for the Fulani can be seen both in twentieth century religious movements and in features of everyday life. Let me give an example of this. Cooperation, as we usually understand the term, does not exist in most Fulani societies. When Westerners use that word we have in mind a group of people working together for a common goal, a goal that will benefit everyone relatively equally. Fulani do work together, but when they do so it is to help specific individuals, not the community as a whole. For the Fulani, the community as a living entity in its own right does not exist; what does exist is the bond of friendship or kinship that links one person to another, and all help that people give one another aims at strengthening such bonds. What we call cooperation, the Fulani see as a kind of coercion, because in working for the common good they are working

to help people whom they do not want to help and whom they might well wish to harm. The only times when Fulani do work in what we might identify as a cooperative way are times when they are working "for God". When they help build a mosque or when they collectively hoe the fields of their religious leaders there is a joyful and giving spirit which largely replaces the Fulani's usual suspicion and indifference concerning group projects.

The marabouts (moodi'bbe, sing. moodibbo) have a number of different functions in contemporary Fulani society. Though a number of them have been important political leaders in the formation of Fulani states, they do not hold political power as a group. The reason for this is that the class of marabouts has no internal structure; it consists of isolated individuals or small family groups scattered throughout the sedentary and semi-sedentary Fulani communities. Some families are traditionally marabout families. They have the family name Cisse, which is actually a title equivalent to something like "reverend" or "doctor" in English, though I don't know the etymological meaning. Not all people with this family name, of course, are practicing marabouts. For being a marabout is to follow a calling, very much like entering the ministry in our own society. Anyone

can attempt to become a marabout, regardless of family or ethnic background; the process is one of prolonged study, often with a sequence of teachers who may be scattered all over West Africa. Early on in this sequence, there is a formal sanction when one learns to recite the Koran by heart, but after that there are no formal grades or degrees, and one's success as a marabout depends not on the extent of one's studies but on how well one functions as a marabout.

The major functions here are curing illness, both physical and mental, acting as therapist, marriage counselor, and advisor on religious and moral questions, instructing children in the basics of prayer and other religious observances, teaching more advanced students the finer points of one's own areas of knowledge (such as theology, philosophy, mathematics, or law), and guiding and officiating in the various rituals of the society, particularly birth, death, and marriage. Thus there are marabouts of all sorts in Fulani society, just as there are priests, doctors, and professors of all sorts in ours. While some of them are venial, narrow-minded, or dull, many are well-educated in their fields, curious and broad-minded, and very stimulating conversationalists. Many of the ones I know myself are part-time marabouts,

in the sense that they make their living the same way everyone else does, but use their free time to study on their own and to give people help when they need it. Some of these services, such as the writing of protective charms, have a widely accepted standard price; more elaborate services, such as foretelling the future, would usually have a fee agreed upon in advance. Other services, such as consultation about personal problems or officiating at a marriage, might be paid for by gifts.

A marabout with a reputation for knowledge, kindness, and success, will usually have a following and may often be the effective principal of a school whose students support him and his family by monetary contributions and by performing most of the hard work, both agricultural and domestic, of his household. It would be incorrect to say that marabouts as a class are looked up to, though nearly all marabouts inspire some fear because a person never knows whether a marabout might have some secret means of harming one. But the best marabouts are viewed by people as being both wise and somewhat detached from the everyday struggles of life, and they can therefore be looked to for guidance in difficult times. In addition, recommendations for action that a marabout makes have a very different ring from suggestions a chief

makes: to do what the marabout says is to affirm your faith in God and to express your hope for yourself and your salvation; while to do what the chief says, is equivalent to admitting your submission to him.

The implication of these observations for social development among the Fulani is that consultation with marabouts might be helpful preliminary to undertaking any project in a given area. One reason for this is that the marabouts are generally the intellectuals of the community and might be more able than others to convey to foreigners (such as AID experts) how their fellow citizens perceive and feel about particular issues. Secondly, if a project had the support of the marabouts it would have a good chance of at least getting a fair hearing and careful attention from the people whom it was supposed to benefit. Finally, if the project required cooperative work or action, a religious emphasis might be more successful than an approach that appealed primarily to reason, self-interest, or fairness.

3. The Fulani and Development

A key personal quality in the Fulani sense of who they are is a strong sense of honor and shame. Not only do the Fulani believe they have this quality to a greater

degree than do their neighbors, but the neighboring peoples themselves willingly concede the point. One saying that I heard in Upper Volta, though unfortunately I can't remember from whom, was that if a Fulani's horse farted the Fulani would die from shame. Though this is not true of course, it can certainly seem to an outsider that Fulani carry their concern with honor and shame to a point that would be considered crazy in our culture. Suicide, for example, seems to be extremely rare in Fulani society, and the only cases I found, when diligently investigating the question, were ones where the person was making a final protest against indignity. In one case, early in the colonial period, a chief who was arrested by the French used a concealed knife to kill himself before he could be taken to jail. Another chief who was taken to jail, at a later period, refused to eat and died of starvation. A good friend of mine told me that he had been arrested under false pretenses once and had also refused to eat; he would have starved himself had the authorities not realized they had made a mistake and let him go. The tough, rebellious spirit that these stories, and there are many more, bring out might well appeal to us Americans, at least at a distance. It must be quite obvious to any

reader, however, that working with such people close up can be extremely touchy. Frankly, while I was pursuing my anthropological research I kept thanking my lucky stars that I was not there to try to get the Fulani to do anything or change their way of life. We shall return later to the significance of all these arrests of chiefs, for they have a bearing on development projects among the Fulani.

A corollary of this high sensitivity to honor and shame is an attitude of superiority and haughtiness towards almost anybody who is not Fulani. This is not at all a kind of group pride such as a patriotic American might have. Where an American would say "my country right or wrong," the Fulani would, at most, say "my relatives right or wrong." A Fulani has no feeling for the Fulani as an ethnic group, but he has pride in himself because he can uphold the standard he was given by being born a Fulani. Being a Fulani is a supremely valuable thing, but it is also very difficult to do it; at bottom, you really have to be born a Fulani to succeed in being one.

Interestingly enough this superior attitude towards members of other ethnic groups does not seem to carry over into attitudes towards the natural world and especially

towards cattle. Many Americans who achieve success in some line of work, whether it be farming, business, or ballet, believe that it was their own intelligence, hard work, and perseverance that enabled them to get ahead. The Fulani, however, would laugh at this idea of success and say instead that success comes from God and from luck. There are a number of reasons for this difference of view, but just one will be discussed briefly here: in both cases the view corresponds to the common, actual experience of people in the society. For an American, success really does seem to depend on choosing a proper line of work for one's talents and on working hard. For a Fulani, however, the major goal is to increase one's livestock and to have many children, and both of these depend on what we would call "natural" forces, namely the fertility of women and cattle and the ability of the young to survive. Fulani would not deny the value of hard work. They consider failure to cultivate a field or to take proper care of cattle as sheer stupidity. But in their experience there is just no direct relation between the amount of work one puts in and the reward in number of cattle or children. (An important exception to this existed when cattle could be obtained by raiding and "children", too, could be gotten

in the form of slaves.)

We have seen that the actual, economic dependence of people on cattle is greater among the nomadic Fulani than among the semi-sedentary ones, but both groups perceive their dependence to be very great. The Fulani, like Christians and Jews, consider God to be a father to them, and they view cattle as somewhat like a father also because they sense that their whole way of life depends so completely on cattle. It is significant that the marabouts and the more fervent Muslims often criticize the less fervent ones by saying, "They don't follow God, they just follow their cows. That's enough for them." This relationship to the cow does not lead to attitudes of awe or worship, but to one of profound respect. This is expressed in everyday life in a number of ways. One of these is to never show greediness for, or undue interest in, the products of the cow. Once when I told a friend that I found the meat we were eating delicious, he said that Fulani would never dare say such a thing; underlying this remark is the notion that to reveal desire for meat or milk is tantamount to viewing the cow's products not as a gift but as a commodity that one controls Now, from a strictly economic point of view, the cow's products are commodities and the

Fulani do control them. Can it be, then, that the Fulani do not perceive this basic economic reality? I believe that Fulani could be led to understand this viewpoint, but that for the most part it is not the relevant one for them. In most areas, raising cattle is not a money-making proposition, but rather a non-profit, people-and-cattle-making one. Fulani see both children and the produce and increase of their cows as gifts of God; their own labor is not seen as "creating" these products at all, but simply as maintaining them while they grow up of themselves.

Another example of Fulani respect for their cattle is their idea that cattle are very intelligent. This doesn't mean they believe that cattle are smarter than men, but that cattle do have a good sense of what is best for themselves and certain sensitivities which other animals and men do not have. Unlike sheep and goats, for example, cattle can leave camp in the morning on their own, wander around all day, and come back at night. Cows that have previously made the transhumance to the salt earth area have been known to leave on their own if their masters don't take them there in time. Cattle are sensitive to dangerous animals and their fine sense of smell can also detect the location of water when rain has fallen great

distances away. Finally, each cow knows its own name and responds individually or together witn the rest of the herd to its master's calls. Melle Dupire writes that Wo'daa'be herdmen can use their herds as a weapon, both for attack and especially defense. "It is an astonishing sight to see the demonstration. The herdman takes off at a run, calling his zebus; they follow him at a faster and faster pace, then, at his signal, they stop and surround him. Protected by a half-wild herd that will obey him alone, he can defend against an outside attack (Dupire, 1962:97)."

One evening I was sitting with some children around the fire outside our hut. Cattle were milling around the huts, as usual, mooing and bellowing before bedding down for the night. Suddenly a boy of about eleven said, "Do you like that cow's voice?"

"I don't know," I replied. "Do you?"

"Oh, it's so beautiful,," he said. "It makes me feel like jumping up and down."

The point of these examples is to emphasize that the close relation of people and cattle is not just economic. Some of the joys of life, and the possibility of pride in being Fulani, come directly from this intimate relation. As we shall see in more detail, there is a kind of feed-back

such that these joys and this pride and the other attitudes I have been describing are actually crucial to the very economic viability of the whole pastoral system.

How does this whole system respond to stress? In one sense, we have already seen this, for we have emphasized that a fundamental quality of the sahel environment is its riskiness. Now we can spell this point out just a little more. The key to the adaptation of both nomadic and semi-sedentary Fulani to the environment is mobility. The specific organization of herd movements varies from group to group and from region to region, but in all cases these movements enable people to get energy -- in the form of milk and herd growth -- that would otherwise be lost. The cows' bellies are collectors of photosynthesized solar energy. Perhaps because the basic adaptation is so successful, it is applied to many other situations of stress, including serious famine, family conflicts, population pressure, political struggles, and war. From our Western perspective we might be tempted to think the Fulani are always "running away" from their problems, rather than facing them and solving them. In my view, however, this is another one of those places where words can mislead us. In our culture, "running away" applies to cases like the man

who ends up fighting with every employer he has and keeps leaving in hopes that the next situation will be better. For the kinds of problems the Fulani have, however, leaving a place and striking out on one's own can be a true solution -- as in the case of overcrowding on the land in a given area. In addition, some social problems, such as political and family conflicts, are partly caused by ecological pressures and can be seen, from an ecological point of view, as a further social mechanism to keep people and cattle thinly spread out so as to make most effective use of the sahel environmental niche.

Another Fulani response to stress is resignation. Just as they do not believe their work has much effect on whether they succeed in life, they regard failures and disasters as being caused by forces over which they also have no control. Resignation is a very common response to problems all over the world, but some Fulani go even a little further in this than their sedentary neighbors, such as the Mossi. Exceptionally, the Wo'daa'be have the reputation of being good at magic and in the preparation of medicines for various illnesses, but semi-sedentary groups generally do not have such expertise. The Jelgobe of Upper Volta are singularly lacking in

medical knowledge. They believe in magic and believe that miraculous cures can be accomplished, but when they want this kind of help they usually go to non-Fulani practitioners. They also go rather rarely to sources of Western medical help, except for people with conditions which have a long history of successful cure, such as spinal meningitis, syphilis, bladder stones, and difficulties in childbirth. (I can only skim the surface of Fulani beliefs and attitudes concerning medicine; proper treatment of that subject would require an essay or even a book in itself.)

It is important to understand the attitude of resignation, because it, too, has its positive side. Though resignation, or fatalism, may hold people back from taking active steps to change a difficult or disastrous situation, it also lifts from them the terrible psychological burden of feeling responsible for that situation. Think of the horrible guilt feelings of a parent in our society, for example, who believes that his or her child could have been cured of an illness if only X, Y, or Z had been done. Given the conditions the Fulani live under, where alternatives X, Y, and Z almost never exist, if people did not believe in their own helplessness they would suffer tremendous levels of guilt and frustration.

If I am correct in my impression that the semi-sedentary Fulani are more resigned in their sense of what they can do than the nomads are, this difference in attitude supports the point I made about the drastic changes which colonial rule brought about in the semi-sedentary life-style. The nomads benefitted from colonialism because they could now move where they wished without fear of their cattle being stolen or confiscated. Colonial rule thus enhanced their all-important capacity to move. But while semi-sedentary Fulani benefitted too from this enhanced mobility, they lost the possibility of a third response to stress which had been important to them, namely the ability to recoup losses or increase their wealth by cattle rustling and by warfare. Today, I believe, there is not any decisive action a young man can take if he wants to increase his herd. Working harder is not the answer, for he is already herding the cattle of many people and there is no guarantee that the work he puts in will benefit his cattle more than those of his friends and relatives. And suppose that for some reason his cattle did start to increase faster than the others that he was herding? People would begin to get suspicious and wonder if he wasn't somehow cheating or even practicing some

nefarious magic or witchcraft. Before the colonial take-over, however, the decisive action of a raid was possible. The reward of success was great, because one's newly increased herd was not only legitimate but admired. And if one died in battle, the anticipated reward was also great, namely that of being remembered and celebrated in song and story. The importance of this cannot be overemphasized. Everybody knows the stories about the heroes of the past. Even for people born long after those days were over, that model for action is the one by which they judge how they are coping with life today. Many young men would say to me, when I played recordings of the traditional music that accompanies the telling of great deeds of the past, "This music stirs me up so much that I feel like going out and killing somebody." Don't in the least take this to mean that the Fulani are about to go on the warpath or are plotting the overthrow of the states they live in. They are quite convinced that this could not happen. The point here is, that the closing off of one of their major channels of action, combined with the loss we mentioned before of their slaves and of their political autonomy (the colonial regime tended to arrest or depose independent-minded chiefs), has undoubtedly increased the Fulani sense of helplessness and the feeling that God

alone can help them now.

THE DJIBO BUTTER COOP. My information about this comes from casual conversations while in Djibo, Upper Volta. It appears that in the 1930's a French Commandant de Cercle tried to set up a butter cooperative in Djibo. This was short-lived for several reasons: 1) the people were simply ordered to bring in their milk and most of them never saw any return; 2) there were nearly insurmountable problems of refrigeration and transport; 3) because of seasonal fluctuations in supply and growing refusal of the people to participate, it became impossible to assure a constant flow of butter to the market. This case touches on a number of points made earlier in this article, but I will just highlight one fact which returns with sad monotony in West African development projects. Whatever the intentions of the planners, the actual details of the projects are frequently executed in an authoritarian and inconsiderate manner.

THE MARKOYE RANCH. My information about this project also comes from casual conversations, primarily with AID personnel and technical consultants, during the period when the Ranch was being set up and after its demise. The original purpose of this AID project seems

to have been to demonstrate good range management techniques to the local population and to make available to them breeding bulls for the improvement of their own herds. I don't know whether local herders made use of these bulls or not, but the ranch simply could not be a going concern because it was too expensive. Even if there had been enough water, (I believe there were problems in this area), the ranch in no way represented anything anything that the Fulani could reasonably learn from. They did not need to be told that grass would grow if cattle didn't eat it, and the fencing in of the range is not only prohibitively expensive but contrary to Fulani custom. Finally, the Markoye ranch was not extensive enough to overcome the spotty nature of sahelian rainfall. Yet had the ranch been much larger, it would certainly have become the target of much anger on the part of local people.

WELLS AND BORE-HOLES. Water has been perceived by everybody, including the Fulani themselves, as the major area where help is needed to improve life in the sahel. Consequently, well-drilling and construction have long been major priorities for the utilization of foreign technical assistance there. One of the advantages of a well, from the point of view of the government or the

donor, is that once a team is set up to do the work, each job is relatively quick and simple, while the result remains quasi-permanently, serving the people for years and years. Generally speaking, when such a well has been constructed in a village to provide a more sanitary water supply to the people, the desired goal has been attained. But the situation is quite different in the case of wells for the watering of animal herds. We saw earlier that among pastoral peoples each well belongs to the person or group that digs it or commissions it. An important ecological side-effect of this social arrangement is that only the cattle belonging to a restricted group of people will normally water at any given well; this limits the number of cattle in a particular area during the dry season and thus helps ensure that there will be enough standing hay to feed those cattle until the rains come. Although pasture is not considered to belong to persons or groups, this arrangement leads to the same result as pasture ownership would. Thus the system of well ownership is a kind of unconscious range management practice.

What is the effect of establishing a public well for watering cattle by hand or a pumping station that brings up the water by diesel power? In both cases, but especially

the second, such a concentration of animals arrives at the wells that the pasture all around them is soon used up and their water thus becomes unusable for the rest of the dry season. Not only that, before this extreme point is reached, a law of diminishing returns operates such that the effort saved in not having to extract the water by hand is effectively wiped out by the effort it takes to bring the herd from the pasture to the well and back again, not to mention the effort of getting and transporting water for human use over ten to fifteen kilometers. This has been observed both in eastern Senegal and in Niger, where the major projects have been tried. Edmond Bernus, a French geographer who specializes in studying the Tuareg, has analyzed the consequences of setting up a pumping station at In Waggeur in the territory of the Illabakan Tuareg northeast of Tahoua (Bernus, 1974a). Prior to 1948, the Illabakan had been able to stay in that region only until the drying up of ponds, which occurs between October and December. In 1948, however, a cement well, 90 meters deep was constructed, from which the water had to be drawn by hand. This allowed the group to remain the region through the dry season. Then in 1961, the In Waggeur pumping station was set up, and almost immediately the Illabakan found

their territory invaded by many foreign groups, both other Tuareg tribes and Fulani. The number of animals watering there was triple the number originally planned to maintain balanced pasturage; at other similar stations, the figure was at least double the figure originally planned and in one case (Abalak) it was four times that figure. The Illabakan were of course very unhappy at this turn of events and they eventually requested the administration to turn off the pump. Some families had even moved away to the edge of the denuded zone and started to dig their own wells by hand. In 1971, perhaps because of the Illabakan's request, the In Waggeur pumping station was closed. That year, the Illabakan put their old well back into operation and were able to pass the dry season near it. "All the tribes that had come these last years had deserted the region, and the Illabakan were the sole masters again, as they had been nine years before (Bernus, 1974a:125)."

The reader should now have in mind the background information that would enable him to analyze what went wrong here. The immediate problem was that neither the government nor the Illabakan had any effective way of limiting access to that water, which was extremely attractive both because of its location (in fresh pasture)

and because it relieved people of the exhausting task of lifting water 90 meters. One reason why access could not be limited is clearly that the well is an anomaly in being a dry-season source of water that belongs to no one. There were no precedents in custom for dealing with that situation. And really serious thought and discussion by the Tuareg about this anomaly was precluded by uncertainty as to whether the machine would really stay in operation or what the state was going to do. Most machines in West Africa eventually stop running and are not fixed or replaced; people are not going to adopt a major change in their lifestyle for anything so precarious.

What should have been done in this situation? I have no ready answer. This is as it should be, for, the kinds of difficulties this project faced could only have been avoided, if at all, through long discussion with the parties that were supposed to benefit from the bore-hole. I am sure that early in such discussion the major difficulties which actually occurred would have been brought up for consideration and good suggestions for dealing with them made.

INTRODUCTION OF CHEMICAL FERTILIZERS, FUNGICIDES AND PESTICIDES. While I was living with the Jelgobe Fulani a French agricultural extension worker (supported, I believe,

by the F.E.D.) came around about once a year to try to encourage the Fulani to protect their growing crops and their harvests with chemicals. I present what follows because it sheds light on how the Fulani react to this kind of project in general. This extension worker would show a film depicting a farmer getting and applying these products to his crops. The film was acted by Mossi, but was dubbed in Fula so that what was going on was easily understandable to all. The extension worker spoke Fula himself and was at that time actually married to a Fulani woman; thus he, if anyone, ought to have been well-placed to induce the Fulani to use these products. But he had little success. Why? For one thing, he never actively sought to learn how the Fulani perceived what he was doing and the products he was selling. Thus he had little awareness of what their objections might be and did not actively try to deal with those objections. The main objections centered around the fact that these projects were powerful poisons. Just the idea of having poisons frightens the Fulani because they immediately think of the possibility that their animals might accidently eat some. In addition, the Fulani have little storage space where they could keep such dangerous products safely away from children. Finally, some Fulani even told

me that putting poison in Fulani hands was dangerous because people would use it to poison one another's cows or wells. I am convinced that fear of being regarded as up to no good dissuaded some Fulani from trying these products. (I haven't studied the question sufficiently to decide whether the value of pesticides really does outweigh their hazards, but I think the issue is debatable.)

LEGISLATION OF PASTORAL AND AGRICULTURAL ZONES. In most sahelian countries there has been a gradual encroachment of cultivated fields on grasslands traditionally used by the pastoralists. This has undoubtedly been caused by the pressure of population growth combined with the inability of pastoralists in the colonial and post-colonial periods to take steps of their own to prevent immigration of farmers into their territories. This is more serious than it might sound because "encroachment" does not mean just a gradual creeping northward of the edges of the farmer's fields: it means generally that the farmer carves out his field in a dry-season pasture area near a well. When this happens, precious pasture reserves for the dry season can be lost (see Barral, 1967). With fields planted near rainy-season ponds or water holes, the problem is the blocking of herd access to the water. Whether this spread of agriculture is good or bad,

it seems inevitable that it will be tried while more and more mouths keep arriving to be fed. The most common way of conciliating the conflicting modes of land use is to insist on keeping a corridor open in the millet fields allowing access to the water. Often this is handled at the local level rather than by national decree (see Horowitz, 1975:398). Niger has promulgated laws with the express intention of limiting the extension of cultivated fields into the pastoral zones, but these have been ineffective in practice because a few good years of rainfall attract the farmers beyond the established frontier (Bernus, 1974b:141).

CATTLE VACCINATION PROGRAMS. All the sahelian countries received considerable technical and economic aid to carry out the Joint Rinderpest Campaign of the 1960's. This campaign seems to have been very successful, and one reason for this success was the assurance given and observed that the number of cattle vaccinated would not be used to determine the cattle tax which all owners had to pay. Fulani and government officials alike agree that the vaccination campaign has been beneficial. It is just possible, however, that its medium-and long-range effects are not all good. There is some evidence that this and earlier veterinary interventions have contributed

to a kind of population explosion in cattle which human institutions, particularly in the severe stress of the 1968-74 drought, were not equipped to cope with. Randall Baker, in an essay on the Karamojong of Uganda, criticizes the disease eradication program carried out there in the 1940's and 1950's in terms that could apply equally well to the rinderpest campaign.

> "...the programme was devastatingly successful and virtually removed the second major check [after shortage of water] on cattle numbers in the district... Disease control ... was considered in vacuo. Just as water development had no complimentary grazing programme, so disease control had no rider to explain how all the extra surviving cattle were to be accommodated on the grazing available (1975:195)."

Baker goes on to say that the growth rate of herds, in the absence of major cattle diseases, was about five percent per year (ibid.): this means a doubling of the population in just under fifteen years. A glance at the figures for the number of cattle in the "burgu" region of Mali between 1957 and 1970 (Rep. du Mali, "Rapport de Synthése", 1972:66) indicates that the growth rate there was about five percent too.

With a growth rate like that, worse famines are clearly in store. One aggravating difficulty is that the human population is growing even faster, so that to the Fulani it does not seem that there are more and more cattle, but less and less. Add to this the factor that many if not

most of the cows in a herd are not the personal property of the herd manager, and we have a situation where choosing which animal to get rid of is agonizing at best. Only a pressing need that everyone recognizes as legitimate justifies selling an animal.

HUMAN HEALTH PROGRAMS. If the human population were constant, or growing significantly more slowly than the animal population, it might make sense to speak of reducing herd size. As we have seen, people and cattle live in a mutually dependent relation such that the ratio between the two has upper and lower limits that cannot be overshot without entailing serious consequences. The pastoralist population, however, is growing very rapidly, though somewhat less rapidly than is the sedentary population in West Africa. According to demographic studies cited by Jean Gallais, the annual rate of population increase among the Bororo is 11 percent, while the average for all the sedentary populations of Niger is 25 percent per year (Gallais, 1972a:307) In concert with the peace established by the colonial regimes, health programs on a vast scale have undoubtedly played a major role in creating this population explosion. Campaigns against smallpox, leprosy, tuberculosis, sleeping sickness, and measles have had a tremendous impact. Birth control programs, however, have not been tried anywhere

and under current conditions there is not a ray of hope for them even if they should be proposed. There are two basic reasons for this, reasons that we have already seen in different contexts; one is that every person's success in life, both economic and social, depends on having children. When the family is a productive unit, as in Fulani society, children are not only necessary for the unit's operation, but they are also the basis for the society's "social security" system. Secondly, just as with opponents of birth control in our own society, to interfere with gestation and birth appears to the Fulani tantamount to trying to control an essentially divine process. The only rural Fulani I ever met, who had the slightest interest in birth control, were occasional women who wanted some way of stopping their rivals or co-wives from having children. I have shown that the Fulani attitudes of resignation, "the Lord giveth and the Lord taketh away," had important psychological and social functions. I would not expect this attitude to change unless there were a radical change toward greater independence in the Fulani political situation in the countries where Fulani live. In the meantime, birth control programs or any other health programs which require the Fulani to take an essentially secular, "rational" attitude towards life processes and the phenomena of health and

illness will at best be re-interpreted according to the Fulani view of how the world works, and at worst be misapplied or totally rejected.

4. Where Do We Go From Here?

It is apparent that the most massive problem the Fulani face, along with the rest of Africa, is a population explosion that is partly or even largely caused by Western intervention in their lives. It might even be more accurate to say that the Fulani's most serious problem is simply the continued impingement of the world economy and Western technology on their traditional ways of life. That is a problem that will not go away and that cannot be "solved". It would be premature to say whether the Fulani have to modernize, after all, the Amish have not, but it is certain that they do have to adjust to living in the modern world. The most that AID can hope for, I think, is to facilitate that adjustment by helping to ease the painful aspects of it, and especially by trying to see to it that human energy does not get wasted nor natural resources destroyed. In more down-to-earth terms, population pressure means increased competition for land, both among pastoralists and between pastoralists and farmers. It means that any augmentation of production may not be

available for export, but will be absorbed by the greater local need. On the other hand, it means that the demand for beef will continue to rise and that herders will be able to get higher prices when they sell. Any efforts to curb population growth would have to be undertaken at the national level, for no ethnic group would voluntarily let the others "get ahead" of it.

In almost all the projects among the Fulani in which AID is likely to be involved, there lurks a serious dilemma that will sometimes be evident, sometimes hidden. There is a basic conflict between the Fulani and the state, and goals that seem relatively straightforward on paper may turn out to be imcompatible in practice. Sahelian governments are eager to increase beef production because it gives them the possibility of foreign exchange. In Upper Volta, for example, cattle bring in 70 percent of the country's export revenues (Gallais, 1972b:368). But, we have seen all along, that the Fulani are not generally interested in beef production; they are interested in Fulani production. The question is, then, are there ways of increasing beef production that do not lead to diminished milk production or other undesirable consequences?

I would like to point out two areas in which undesirable consequences might well arise. The first might have come

to the reader's mind already, for we have hinted at it before, namely the division of labor between men and women in Fulani society. If an increase in beef production were going to mean a necessary decrease in milk cows and milk production, this could have serious effects on the husband-wife relation and on the viability of the family as a productive unit. I don't mean to imply that Fulani society would necessarily collapse because of this, but that the problem must be watched out for. The second area of undesirable consequences is less direct, yet it may already be operating. When we speak of "beef" or "milk" we are in both cases looking at the commercial end product from the viewpoint of people used to living in a market economy. But the Fulani still live largely in a subsistence economy, so that, from their point of view, the choice is not between milk and beef, but between milk and money.

Now, what would the Fulani want money for, on the scale they would get if they sold fully grown animals? Out in the bush, there is nothing to buy except more cows, and if a person has money and doesn't spend it, it will soon be frittered away in the form of small gifts (to friends, wives, children) or large gifts (to griots or beautiful women). In the city, on the other hand, there are plenty of ways to spend money: clothes, radios, tape-recorders,

bicycles, mopeds, and so on. The only problem is, you just don't see Fulani herdmen strolling through the bush alone with their cattle, wearing fine gowns, as they listen to the news on their latest model Hitachi eight-band portable radio and cassette-recorder. All these items are symbols of luxury and leisure, and they are coveted mainly to impress and attract other people. We, in American culture, work hard to be able to acquire such items and then convince ourselves we have leisure because we use or display them a few hours a week or even a few hours a year (such as a sailboat). For the Fulani, to work hard for such a goal would be absurd. To be rich is synonymous with not having to work and with having friends, servants, and hangers-on constantly around to chat with or do one's bidding. The griots, as they declaim flattering phrases to a chief, often praise him for being always surrounded by company: "You are never alone," they say.

This is the model of wealth that the Fulani know. It is exemplified by chiefs, important marabouts, traders, goldsmiths and, nowadays, civil servants. It involves an essentially sedentary lifestyle that is radically different in spirit from the way of life lived by the pastoral Fulani in the bush. Though pastoral Fulani would generally say that such a life is not for them, they recognize its

attractiveness, and some young and middle-aged men do long desperately to be able to emulate that way of living. A few can't resist the temptation to seek its pleasures and buy the goods that symbolize it. They sell their cattle, sometimes other people's as well, and disappear more or less permanently into the cities.

A key cultural factor that helps maintain the gap between the pastoral and the sedentary systems of value is the view we have already noted of cattle as a kind of investment portfolio. Thus, while it is possible to convert this "portfolio" into cash, there is an extreme reluctance to do so. It is significant that the normal way of saying "to spend money" in Fula is to say that you "eat" the money. To say of someone that he "ate" money is invariably a critical remark not only because it implies that he was self-indulgent, but also because eating itself is somewhat shameful in Fulani culture. It implies a giving in to base human needs that is unworthy of a true noble. We saw earlier, that while it was all right to accept the gifts (milk, and occasionally meat) that the cow offered man, it was very bad form to appear to <u>want</u> them. This is where the importance of Fulani pride shows up in the economic system. An essential part of the pride of being a Fulani lies in the capacity for self-mastery which is highly cultivated in Fulani society. Thus, there is strong social pressur

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against selling cows, not because they are prestige items, but because to do so diminishes one's capital and at the same time reveals one as "eating", i.e. giving into a weakness unworthy of a Fulani. Do we not also speak of "eating into capital"?

These cultural facts have several serious implications for development. One is that keeping alive traditional Fulani values is probably crucial for the Fulani ability to maintain their herds in the difficult sahel environment. Everything depends on not giving in to the temptation to "eat" the cows. Encouraging the Fulani to become oriented to beef production, however, inevitably means increasing the temptations to sell animals. This could be highly dangerous unless valid alternatives to "eating" the money were available.

To put the conflict in a slightly different way, and as concisely as possible: the pastoral way of life (both nomadic and semi-sedentary) is hard; therefore its practitioners must have rewards and <u>those rewards must be usable while continuing to live as a pastoralist</u>; money, today at least, appears not to fulfill this condition. Of course the traditional rewards of being a Fulani do fulfill this condition very well, but, as we have seen, the colonial and post-colonial experiences have weakened some of those

rewards. This is particularly true for the semi-sedentary Fulani, with their reduced political independence and the unavailability of a resort to arms. I may have been witnessing the effect of this trend during my stay with the Jelgobe of Upper Volta. There was general agreement among old and young both that people did not "love" cows as they used to. This was evidenced by the fact that fewer young men were willing to go on transhumance than in previous times (not just the "old days," but even ten years before), and that cattle were allowed to wander every day in the bush untended. Only rarely would someone, usually an older person, graze the cattle in the middle of the night, which is one of the best feeding times for cattle. The Jelgobe themselves gave me two other yet related interpretations of these trends. Some people said the reason people no longer guarded the animals was that there was no longer any danger of raids by foreign rustlers, Fulani or Tuareg. The explanation given by the chief of Djibo was simply that the people had enough to eat. This came out in a conversation we had in 1974 or 1975 concerning the recent famine; the chief was predicting that I would see people taking better care of their cows now that they were hungry than before the famine, when they were full. Unfortunately, my observations were not extensive enough

to confirm or disconfirm his prediction, but my hunch is that he was right.

We have seen that, down to the present, the nomadic and semi-sedentary Fulani have been living a mode of life that is particularly well-adapted to capitalizing on the risk inherent in the sahel environment. It is a life of considerable physical hardship and discomfort, with the additional stress, for those who practice transhumance, of living away from the family (and usually without women) for long stretches of time. The Fulani have made virtues of the ability to face these hardships and have evolved a number of social devices that help them resist the temptation to sell off their cattle and live more lavishly: for instance, their disdain for neighboring peoples who live a "softer" life. The other side of the coin of this reluctance to sell their cattle is that the Fulani at the moment have almost no dependence on Western products or the Western economies in general. This is in striking contrast to the situation of many farmers in Third World countries who must sell their harvests on the world market in order to make their living. In my opinion, the Fulani are better off for this isolation. I don't mean to suggest by this that interdependence in general is bad, but that it is a relation to be entered with great caution at a time when the

industrial economies are themselves uncertain and the price of petroleum-based energy is soaring with no prospect of ever coming down. In any case, I feel it would be irresponsible to push machines or processes that would increase petroleum consumption; especially if our own economy should get into more serious trouble in the next decade or so, there is no reason the Fulani should have to suffer.

Thus, we are confronted with what appears to be a paradox; one of the major Fulani strengths in a development context is their conservatism. We noted the Fulani resistance to education. While that resistance may have bad consequences for them, I think we can see now that it is part and parcel of attitudes that are necessary for good herd management. Cattle are not viewed as a means to the end of making money, but are a kind of end in themselves. Although the Fulani definitely believe in individual ownership of cattle, their fundamental attitude toward them is more like that of a trustee watching over a trust. We have seen that, in fact, the cows tended by a herd manager do not all belong to him, and even his own cows are viewed as belonging partly to the inheritors who will eventually receive them. That the Fulani tend to place the health and safety of their cattle ahead of their own ease and comfort, is a definite asset in the time of severe stress that the economies of

the sahelian countries are now entering. I believe that the development programs that will most benefit the Fulani and the countries they inhabit are ones which build on, rather than attack, these basic Fulani values.

Another strength the Fulani have is the ability to recognize a problem and take concerted action to deal with it in a traditional framework. We saw that cooperation in our usual understanding of the term is foreign to Fulani thinking, but there are other modes of concerted action. The difficulty with these modes is that they tend to have political, religious, or military overtones which are either threatening to governmental authority or illegal in the context of national order. The most striking example of this sort of "self-help" is the pastoral code of the Dina, set up by Sheku Amadu and the Great Council in year three (1821) of the Dina, the Fulani religious empire of Macina. The aim and largely successful accomplishment of this code was to organize the movement of cattle and other ruminants so that the delta region of the Niger could support both pastoral and non-pastoral economic activities such as millet farming, rice farming, and fishing. Areas for pasturing in the burgu and for farming were clearly delineated; migration tracks were given fixed locations, as were stopping places and river-crossing points. Sheku Amadu

wanted the Fulani to be more settled so that they could pay more attention to God, so he gave to the transhumance practices a quasi-military organization which enabled the majority of the faithful to remain at home while a small number of young men took all but a few milk cows to distant pastures and salt earth areas (Gallais, 1975:358-359; Rep. du Mali, 1972, "Annexe A;" "Aspects sociologiques des conditions de l'élevage en région de Mopti":AII/4-AII/6).

Other examples of action, on a smaller scale, that I have heard about or seen, are driving off diseased cattle from wells so as not to spread the infection to other cows, policing the bush to prevent unauthorized cutting of tree-branches to feed goats, and putting out a brush fire and punishing the people who set it. This last case is interesting because it illustrates the bind the Fulani are in with respect to the authority of the state. As soon as the smoke was spotted on the horizon, people mobilized for action. Fire was dangerous here, because what was burning was dry season pasture. Men took axes and hurried to the scene, which was about ten kilometers from the village where I lived. People poured in from all the surrounding villages. Women followed as fast as they could, carrying pots of water on their heads, not to put out the fire, but to refresh the men. Basically, the technique used was to

beat out the burning grass with leafy branches. Towards evening the fire was under control and the older men held a council. Some were for following the tradition in such cases, which was that everyone go and "eat" the person who had started the fire. This means simply that all the men pay a visit to the offender; as a good Fulani, he must offer food to his guests or suffer great humiliation. To feed such a large delegation would be equivalent to a large fine, since he might have to slaughter most of his animals (note, however, that no one person would get a profit, since the "fine" is consumed on the spot). Other men felt that they might get in trouble with the government if they followed this tradition and said that they should do nothing until the authorities had been notified. This recommendation finally prevailed, the authorities were notified, and the gendarmes came and arrested the youths who had set the fire (through negligence), letting them off after a light fine.

Finally, I would like to mention a fascinating example of initiative being undertaken by most of the nomadic and semi-sedentary Fulani living near the left bank of the Niger river, south of a line from Tillabery to Filingue. The aim of this initiative is to formalize traditional patterns of lending out animals, to build an institution

that can enforce the obligations these loans entail, and to develop a spirit of cooperation based on religious feelings and on traditional Fulani attitudes towards cattle and herding. This institution is called Laawol Fulfulde, which I would translate as "The Way of Fulani Wisdom"; this phrase has been translated into French as, "La Voie de l'education peul (The Way of Fulani Education)." It is based on a custom called nanga na'i or ha'bba na'i ("grab cows," or "tie up cows") which is common to both nomads and semi-sedentary Fulani in the Niger-Nigeria border region. This custom, as described for the Wo'daa'be for instance (Dupire, 1962: 136-138), involves only the contracting parties and their descendants who continue the relation, while Laawol Fulfulde is a kind of club which herders join voluntarily and which not only enforces the obligations of men who have such a loan between them, but also acts to ensure that no harm comes to the cattle of members and that members help one another in time of need. For example, if a member sees that a fellow member's cow is hurt, or has strayed into a field, and does nothing about it, then Laawol Fulfulde will fine that person for his inaction. Similarly, if a man's wife is sick and he wants the herding group to put off its departure until she is well, the group is supposed to wait. But if one person

leaves anyway, Laawol Fulfulde will fine him also. These are but a few of many situations dealt with (CRRDTO, 1969, "Ha'bbanaaji" pars. 12-16).

I have mentioned implications for policy in the facts and ideas under discussion; here I will reiterate a few of these and suggest more specifically what kind of help I think would be most beneficial to the Fulani. Keep in mind in what follows, however, that one of the best things that could happen, namely a slowing down of the rate of population growth, would have to be handled, if it can be affected at all, at the national and international level rather than the level of the ethnic group.

THINGS TO BE CAREFUL ABOUT. The Fulani, like other traditionally oriented peoples, have many practices which do not appear to be "rational" according to our way of understanding but, as shown, many of these practices have reasons for being that are not immediately apparent. A good rule of thumb to follow, then, when envisaging a change in a seemingly "irrational" practice, is to assume that there is some valuable end which that practice serves, which the people may or may not be able to articulate. The point here is not that changes should never be made, obviously some changes are necessary, rather, it is that we should know as completely as possible what we are actually

giving up when we make a change, so that we can better judge its true potential value.

Second, there are two potential dangers should an increase in the efficiency of Fulani cattle production occur; one is that it might simply drive large numbers of Fulani out of the sahel, since they would no longer be needed to produce the same number of cattle. But to go where? This would ultimately be a disservice both to the Fulani and to the particular country concerned. The other potential danger is a shift in emphasis from an interest in cattle to an interest in money and what money can buy. To some extent, this transformation is already occurring; among its effects are the too rapid selling off of cattle and a reluctance to go on enduring the hardships that accompany taking proper care of cattle in the sahel. This being the case, it is imperative that, if there is an attempt to orient the Fulani towards beef production, some suitable way be found of immediately investing the money from sale of a large animal. An intriguing response to that very problem might be Walter Goldschmidt's concept of the "national livestock bank." This is a kind of savings bank in which the owner would "deposit" an animal and receive a certificate which would be redeemable at any time for an equivalent animal. This would get unwanted

animals off the range (they could then also be fattened) and would give the owner the assurance of having a redeemable animal in case of bad times (Goldschmidt, 1975).

THE BEST APPROACH. A major cause of the failure in large development projects is that the people who are supposed to benefit from them rarely participate in planning or executing them. This means that the experts lack information of two kinds; they lack the pastoralists' own detailed knowledge of their milieu and their animals, and they lack insight into how pastoralists would react to, or make use of, the project's installations. There may indeed be some proposals to establish infrastructure which could be quite beneficial to the Fulani, but what the Fulani need most right now is good communication. Fulani are always talking among themselves about what they see happening in the world around them, but they seriously lack information that would help them make better decisions. Up to the present, when anyone has done anything for the Fulani, whether it be building a well or performing surgery, the process has always been authoritarian, unilateral, and without sufficient explanation of what is going on. For example, many people have been vaccinated against smallpox and measles without having the slightest idea what was being done to them; it was just another strange order they had to obey or risk being thrown in jail.

The Fulani lack information about the services available to them in their countries, about the laws and their sanctions, about the reliability and side-effects of various medicines, both for humans and animals, and about how events in the world outside might impinge on them, such as raising prices for oil, beef, coffee, cocoa, and grain. One of the best things AID could do, would be to help create channels of communication that would be non-threatening to the Fulani so that this sort of information would be available to them.

The way I suggest that this be done, is through people who would be somewhat like county agents in the United States. They would also be part teacher and part "group facilitator". Their job would then include both informing the Fulani of world events and trends that are relevant for their concerns, and learning from the Fulani what they see as their greatest problems. After such a person had lived somewhere long enough to become familiar to the people, for example, I can well imagine that he might get the local imam to help him organize meetings at the mosque, after the Friday prayers, where such information and points of view could be exchanged. People already use these occasions to talk among themselves about current issues. The "facilitator" might also have a more active function; he could prod people into thinking about and talking over problems which they had not yet fully faced or noticed, and he could propose to them

solutions or ideas which had been tried or thought up in other places. In addition, if a road, dam or abattoir were to be built, such a person would be extremely well-placed to learn how it is viewed by the Fulani and, thus, how the Fulani would react to its installation. At the same time, he could help the local population work out a fruitful adjustment to the changes it would create in their lives.

The project I am proposing involves people rather than material. These two factors are not mutually exclusive, but I strongly feel that better communication is a necessary precondition for any investment in material or public works. I suspect that AID lacks personnel with the necessary training and interest to do this kind of work but one way of getting around this problem would be to subcontract the communications part of the work to the Peace Corps, or to graduate students in anthropology, sociology, linguistics, religion, psychology, etc. who would appreciate the chance to live with an exotic people for a couple of years. These people could be in continuous discussion and training with AID technical experts in various relevant fields, such as range management, veterinary medicine, agronomy, and so on. Such a program might very well lead naturally into more technical projects and, in any case, it would have the indisputable value of being informative to all concerned and of helping to head off projects that would be boondoggles or disasters.

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IV. THE CONDITIONS OF AGRICULTURAL INTENSIFICATION IN THE WEST AFRICAN SAVANNAH

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Introduction

The intensify of agriculture, as we define it here, ia: (a) a measure of the frequency of land use, (b) a classification of agricultural techniques that promote more continuous cropping and the restoration and maintainance of soil fertility, and (c) a means of increasing yields by raising inputs of energy (principally labor) on a fixed area of land. In the simplest terms, intensive cultivation is that system of agricultural land use in which fields are planted with crops for longer periods of years than they are allowed to remain unfarmed or fallow. The most intensive system would keep the same field in annual production or, by means of multicropping, produce several successive harvests from a single plot in one year. A piece of land farmed two years out of every three or six years out of ten could be technically referred to as intensively used. In contrast, the extensive system of shifting cultivation (also called slash-and-burn, swidden,

bush fallow, etc.) makes use of impermanent fields planted with crops for shorter periods of years than they are left fallow (Conklin 1961). The clearing and burning of bush or forest cover releases nutrients accumulated in the vegetation and removes plants that would compete with the growin crops. Over a few years of farming, the amount of phosphorus and potassium from the ash, the level of humus, and the amount of nitrogen and phosphorus mineralized from it decline (Nye and Greenland 1965:123). Crop production is further reduced by heavier growth of weeds and insect predation until the field must be fallowed for natural regeneration. In many areas 15 to 20 years may be required for the accumulation of necessary nutrients, and fallows shorter than 4 to 8 years may cause forest to be replaced by grass. Efforts to keep a field in more continuous production and shorten or eliminate fallow periods while preventing sharp declines in fertility reflect intensification. The greater frequency of land use and a higher ratio of crop to fallow years distinguish the process of intensification.

Under conditions of continuous farming, it is necessary on all but the richest alluvial or volcanic soils to artificially preserve or restore soil nutrients and physical

properties and limit the competition of undesired plants, insects, and animals. Intensification thus requires specific techniques such as manuring or other fertilization, more complete initial tillage, repeated weedings, and crop rotation. Leguminous plants or trees beneficial to the soil are often encouraged. Changes in field surfaces may be made as in terracing to reduce erosion, ditching to improve drainage, or leveling to allow effective irrigation. Rainfall may be supplemented by retaining floodwaters with dykes, building dams and canals on permanent streams, or raising water from wells. Ridging and mounding may further conserve soil and control water. Fences are sometimes constructed and the guarding of ripening crops becomes necessary. Extra tasks such as seed selection, transplanting, thinning, or selective harvesting along with more precise scheduling of agricultural activities often become important in the course of intensification. As these techniques are applied to a landscape, areas of waste or forest land tend to recede and fields become more clearly bounded, more regular, and more neatly kept.

Rather than defining intensive and shifting cultivation as distinct and mutually exclusive types of cultivation, we want to emphasize the fact that they actually represent intergrading bands in a spectrum of agricultural land use.

Most farming groups know and practice both more and less intensive methods at the same time, for example, by clearing bush fields for millet while growing vegetables in permanent dooryard gardens. Agricultural change can be seen as moving in one direction or the other along a continuum. Shortening fallows signifies a trend toward intensification even if manuring has not yet been introduced. An increase in the proportion of land or labor devoted to more intensive uses reflects the same transition. Under other circumstances a group may "disintensify," adopting extensive techniques and crops that require less care.

Intensive agriculture in West Africa has been little studied until recent years because shifting cultivation appeared dominant in most forest and savannah areas and because distinctive elements of other systems such as animal traction with the plow or irrigation networks were absent. Evidence for intensive cultivation came chiefly from remote, often mountainous areas where small ethnic groups had avoided incorporation into traditional states and maintained their indigenous social and religious organization. Such so-called "hill pagans" were seen as refuge populations escaping assimilation by more powerful neighbors who occupied the plains and maintained long-distance trade routes. The Kofyar on the southern escarpment of

the Jos Plateau in Nigeria exemplify this intensive pattern (Netting 1968). They grow an association of millet, sorghum, and cowpeas with interspersed vegetables and tree crops on permanent homestead farms of one to two acres. Soil fertility is maintained by annual application of composted organic material from corrals where tethered goats are fed grass and leaves. To prevent soil erosion and retain rainwater, hillsides are terraced and waffle-like ridges (basin listing) are constructed on fields. Mounds and ditches are used to drain swampy areas. Even bush fallowed fields are given application of cooking-fire ashes and are double cropped with nitrogen-fixing peanuts and transplanted millet. The agricultural system adequately fills subsistence requirements and supports population densities of 60 to 200 per square km.

Many of these same practices have been described for other hill dwellers such as the Kabre of northern Togo (Froelich 1963), the Dogon of the Bandiagara plateau in Mali (Paulme 1940, Palau Marti 1967), and the Mafa of the Mandara Mountains in northern Cameroun (Boulet 1975). The Mossi of Upper Volta (Mangin 1921, Hammond 1959) and the Serer of Senegal (Lericollais 1972) use a variety of intensive methods in more open plains environments (Figs. 1-3). Many of these groups use animal dung as fertilizer,

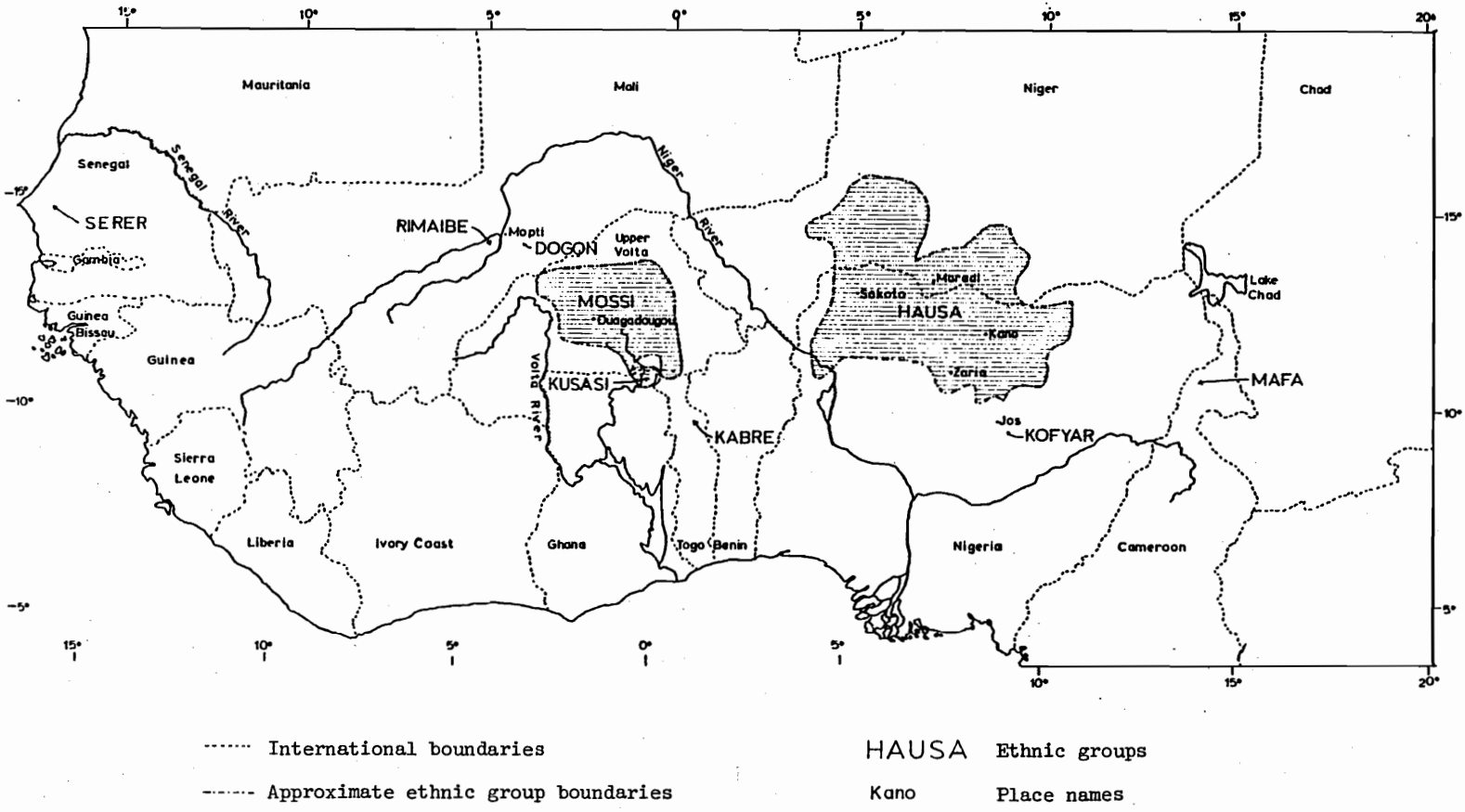

Figure 1. Location of ethnic groups practicing intensive agriculture.

Figure 2. Cross-cultural comparison of agricultural techniques

Tribe	Mossi	Dogon	Kabre	Serer	Mafa	Kusasi	Kofyar	Hausa	Rimaibe
Agricultural practices									
Animal traction	1			1		1		1	1
Manure-planned pasturing of animals		1		*	1	1	1	1	
Manure-stabled animals	1	*		1	*	1	1	1	
Manured "house gardens"	1	*	*			1	1	1	1
Manure-nearby fields	1	*	*		*		1	1	
Use of trash/refuse	1	1			1	1	1	1	
Tillage/turning	*	*	*	*	*	1	1	1	1
Mounds or ridges, squares	1	*	1		*		1	1	
Large mounds							1		
Use of compost soil placement (or turning in of vegetation)		1				1	1		
Slope retention		*	1			1	1		
Terracing			*		*	1	1		
Soil drainage		1	1		1		1	1	
Irrigation		1						1	
Inundated cultivation (or low-lying areas)	1	1	1	1	1			1	1
Water retention dams		1							1
"Dry season" cultivation	1	*				1		1	
Encouragement of *Acacia albida*				*		1		1	
Killing of insects		1	1						
Major crops interplanted almost always	*		*			1			
Some major crops segregated		1(?)		1	1				1
Some major crops interplanted				1	1				
Only gardens continuously cultivated						1			
Repeated non-garden cultivation	1	*	*	*	*	1	1	1	1

Figure 3. Cross-cultural comparison of agricultural crops and techniques

Tribe	Mossi	Dogon	Kabre	Serer	Mafa	Kusasi	Kofyar	Hausa	Rimaibe
Population density (per km^2)	-	100	70	85	245		60-200	20-350	10-25
Rainfall (mm per year)	500-900	-	1500	764	1000	950	1000-1500	500-1500	550
Basement rock		sed.[a]	grn	marl[b]	grn[c]	grn	grn	grn	
Crops									
Eleusine coracana (L.) Gaertn. (finger millet)					1		1		
Oryza glaberrima Steud. (African rice)									x
Sorghum bicolor (L.) Moench (sorghum)	x	x	x	x	x	x	x	x	
Digitaria exilis Stapf (fonio or hungry rice)		1					1		
Pennisetum americanum (L.) K. Schum (pearl millet)	x	x	x		x		x	x	1
P. gambiense Staph and Hubbard				x					
P. pycnostachyum				x					
Zea mays L. (corn)	1	1	1			1	1	1	1
Oryza sp. (rice-variety not specified)	1	1	1	1	1	1	1	1	1
Manihot esculenta Crantz (cassava)		1	1	1			1	1	1
Discorea sp. (yam)	1		1		1	1	1	1	
Allium cepa L. (onion)		*				1		1	?
Lycopersicon esculentum Mill. (tomatoe)	1	1				1	1	1	?
Hibiscus esculentus L. (okra or gombo)	1	1	1		1	*	1	1	?
Arachis hypogaea L. (peanut or groundnut)	1	1	1	x	x	x	1	x	1
Gossypium spp. (cotton)	1	1		1		1	1	x	1
Vouandzeia subterranea (L). Thou. (Bambara groundnut)	1		1		1	x	1	1	
Indigofera arrecta Hochst. ex A.Rich.(indigo)	1							1	
Vigna unguiculata (L.) Walp.(cow peas)							1	1	

Figure 3 continued

Tribes	Mossi	Dogon	Kabre	Serer	Mafa	Kusasi	Kofyar	Hausa	Rimaibe
Cannabis sativa L. (hemp)	1						1	1	
Nicotiana tabacum L. (tobacco)	1	1			1	1	1	1	1
Sesamum indicum L.	1				1	1	1	1	
Colocasia esculenta (L.) Schott (taro)	1		1		1		1		
Ipomoea batatas (L.) Lam (sweet potato)	1	1			1	1	1	1	
Butyrospermum paradoxum (Gaertn.f.) Hepper subsp. parkii (G. Don) Hepper (karité, shea butter tree)	1	1				x		1	1
Parkia biglobosa (Jacq.) Benth (néré, dawadawa)	1	1	1			x	1	1	
Elaeis guineensis (oil palm)	1						1		
Borassus aethiopum Mart. (wine palm)				1					

Key: 1 = characteristic present

* = characteristic present and very important

x = staple crop

(a) sedimentary

(b) calcareous marl

(c) granite

often pasturing cows or small stock on fallow fields, as well as collecting manure from stabled animals. Where stall-fed animals are kept in the compound, the pattern of manure application typically reflects the difficulty of its transport (Sautter 1962), and fields nearest the compound are most adequately fertilized. It is often possible to discern three concentric zones in the fields: house gardens, intensive non-garden cultivation, and non-permanent fields at a greater distance from the house. These zones frequently correspond with densities of Acacia albida, a leguminous tree which symbiotically fixes nitrogen in the soil. Gardens and garden crops receive a good deal of care. Among the Dogon, and, to some extent, among the Mossi, this includes some double-cropping, particularly in tobacco and in onions. Most groups take advantage of naturally low-lying, water retaining areas for dry season cultivation.

Though farmers with well developed and long standing traditions of intensive agriculture employ a variety of specialized techniques, the most time consuming tasks remain hoeing and weeding (Boulet 1975:55, Lericollais 1972:72). Mafa cultivators hoe their millet up to four times during the growing season, and the 44.7 per cent of total hours worked outweighs that devoted to care of livestock, spreading of manure, and so on. For the Serer,

hoeing and weeding took up about half of all time spent in agricultural work.

Our cases of somewhat isolated peoples with very intensive indigenous agricultural systems suggest that intensification has a long history in West Africa and is probably not based on recent innovation or diffusion of techniques. Though they illustrate the possibilities of intensification using local crops and relatively simple techniques, they are perhaps not the most representative examples of on-going or prospective agricultural change. Pockets of permanent cultivation often originated in restrictions on available land due to historic threats by neighboring peoples, and when tribal warfare ceased to be a danger, people often left their mountain retreats. Most of these societies also grow food primarily for subsistence, and often they are poorly situated for producing cash crops and participating in the market economy. In attempting to more accurately judge the factors that both promote and impede intensification, we have selected for more detailed discussion the rice-growing peoples of the Niger inland delta in Mali, the Kusasi of northeastern Ghana, and the Hausa of northwestern Nigeria. Our aim has been to contrast the process of intensification under a range of different environmental conditions, crop complexes, and

political economic situations in an effort to detect common elements and assess their relative significance.

The definition of intensification we have offered is a simple one designed for easy identification of intensive systems and their characteristic methods. Frequency of land use can be readily ascertained, and the presence of techniques such as manuring or erosion control can be observed in the field. Intensification is not always equivalent to higher yields, more efficient production, or greater labor intensity, and a major goal of our analysis will be to determine more precisely what these relationships are. For instance, annual yields per unit of land under intensive agriculture may be either lower or higher than those of shifting cultivation, but the fact that the land is kept in permanent use means that its average production over time is sure to be higher than that of a bush field with its long fallow period. It is also probable that there is less yearly fluctuation in crop production under an intensive regime. If farmers do, as we believe, make rational economic decisions in achieving certain levels of production from their available land resources and technology they must choose the manner in which they allocate labor. We have seen that shortening fallow periods reduces the amounts of nutrients stored in the vegetation cover, and

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also reduces the amount of humus accumulated in the soil. In addition, the nature of the fallow cover often changes -- from secondary forest to bush or to savannah. Fields cleared from bush or from grassland require hoeing and weeding, which, as noted above, is costly in terms of time. In addition, there is the necessity to compensate for decreased levels of soil nutrient accumulation (Boserup 1965:31). Thus, intensification of land use increases labor requirements.

One way to visualize intensification of land use, is with the population function for a single variable input (Upton 1973:21ff) as is done in microeconomic models. If you assume that all factors but one (labor, in this case) are fixed (i.e., that you have a fixed plot of land), it is possible to examine the relationship between labor inputs and product, pictured in Figure 4. Product is expressed as total physical product per year, as average physical product (total product divided by units of labor), and as marginal physical product (the extra product or output added by one extra unit of labor (Samuelson 1970:518). As one keeps putting in more units of labor, the marginal product (after an initial rise) starts to decline, eventually reaching zero and becoming negative, as the law of diminishing returns says it ought to.

The average product of labor will be greatest at point

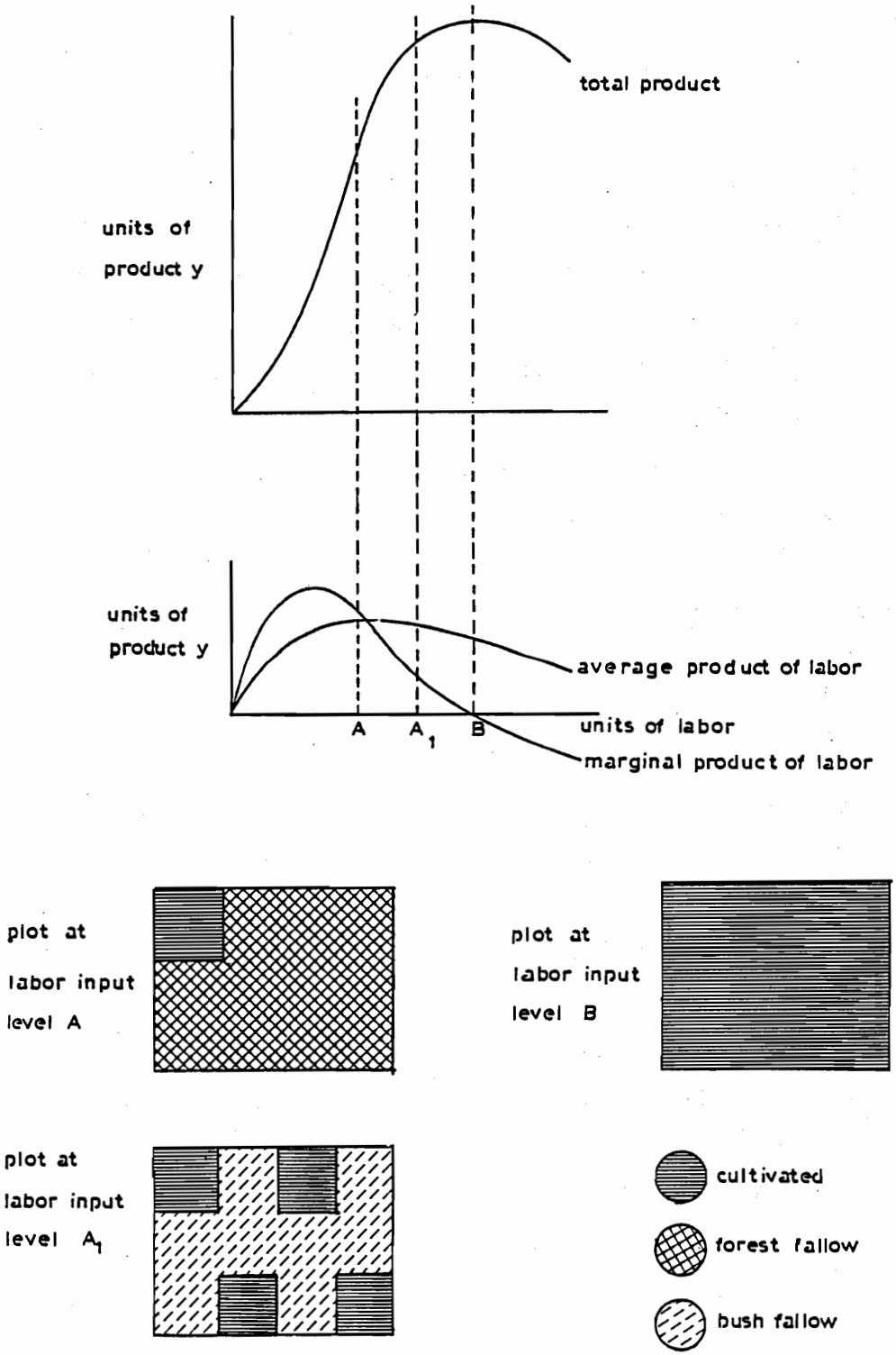


Figure 4. Schematic representation of total, average, and marginal products of labor for plots of different cultivation intensity.

A, which corresponds, in the scheme above, to the labor input for slash-and-burn cultivation of the plot, permitting a long fallow between cultivations. As the fallow period shortens, labor inputs move toward point B: while total product rises, the average product of labor (or labor productivity) falls.

If you assume the cultivators of the plot behave like economic men, then, in making production decisions, they will be weighing the value of the marginal product for a unit of labor used in agriculture, against other uses for that unit -- in crafts, in wage labor, and so on. As labor inputs to the plot increase, and as marginal product of labor decreases, alternative occupations become more and more attractive. (A more detailed explanation of labor intensification in micro-economic terms can be found in Upton 1973:100-116.)

Actual figures for average and marginal products (expressed in kg wheat equivalent/man-hour), and for labor inputs (expressed in man-hours/ha/year) are shown in Figure 5. Because the data were plotted on a log-scale, they differ in appearance from the curves of Figure 4. The story, however, is the same -- as labor inputs rise, labor productivity, and the marginal product of labor decline. The data used are from community studies of Gambian peanut

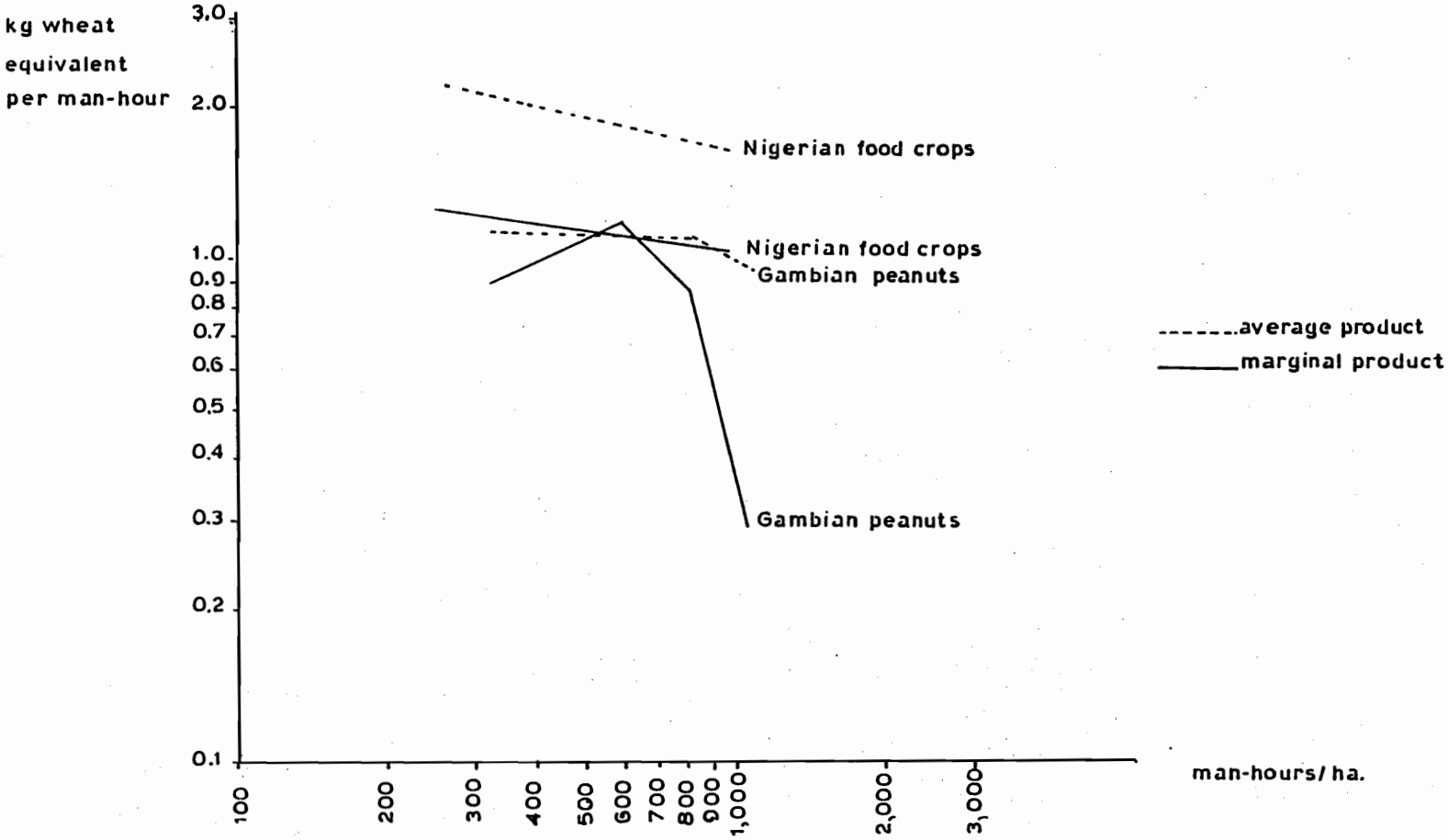


Figure 5. Actual average and marginal products of labor, for two groups of African cultivators.

cultivators, and for Nigerian farmers producing food crops (Clark and Haswell 1967:92-96). For the Gambian cultivators, the decline in marginal product was especially rapid, for labor inputs above approximately 800 man-hours/ha/year. The investigator noted:

> "The author's experience in the village showed that cultivators did in fact stop putting any further labor into cultivation at about this point. The Gambian male cultivator may not be able to read or write, but he knows the difference between marginal and average product, which is more than can be said for some highly educated accountants" (Clark and Haswell 1967:97).

Unfortunately, marginal product figures are not available for the other crops of this Gambian village, but Figure 6 shows the productivity for rice cultivation (carried out by women), and for millet cultivation, and it should be noted that productivity is lower for these subsistence crops (expressed in wheat-equivalents) than for peanut cultivation. Figure 6 also shows data from three Hausa villages for both upland fields of millet and sorghum, and for low-lying fields of sugar cane. The low-lying fields, in all three cases, show higher average productivity than do upland fields, due to being better supplied with water. When the three villages are compared, the negative relationship between labor productivity and labor inputs/ha shows clearly for both low-lying and for upland fields.

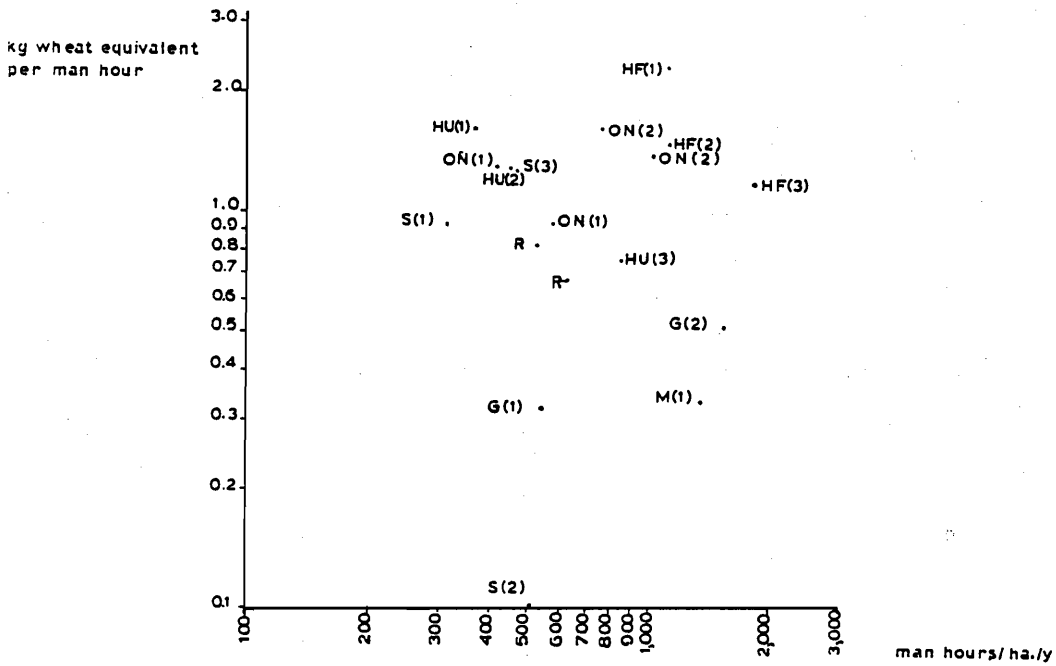


Figure 6. Average productivity of labor in selected West African localities.

Key: Graph symbol	Tribe and crop
S (1)	Serer late millet/sorghum; Lericollais (1975)
S (2)	Serer early millet
S (3)	Serer groundnuts
R	Rimaibe - traditional rice; Gallais (1967)
ON (1)	Office du Niger - without transplanting; de Wilde (1967)
ON (2)	Office du Niger - with transplanting
G (1)	Gambia millet; Clark and Haswell 1967:99)
G (2)	Gambia rice
M (1)	Mafa millet; Boulet 1975:67)
HU (1-3)	Hausa upland (millet-sorghum) fields; Norman (1972:E12)
HF (1-3)	Hausa <u>fadama</u> (low-lying) fields - sugar cane; Norman 1972:E12)

Figure 6. Average productivity of labor in selected West African localities.

The reasons for this kind of variation within a single community will be discussed further below.

The other data points in Figure 6 show average product (labor productivity) for different crops grown by cultivators in communities within the 1100 mm rainfall zone. We see that the Serer (see Figs. 2, 3 and map in Figure 1), the Rimaibe, and the Office du Niger (map in Figure 1) have, in general, relatively lower levels of labor inputs, and relatively higher productivity, than do the Mafa (see Figs. 2,3) of the Mandara mountains, Cameroon (Figure 1). We also see that population density for the Mafa is far higher than for the Rimaibe or the Serer. The relationship between population density and labor intensification will be discussed in another section.

Another point to be made about these figures for labor productivity is that they will vary from year to year, for regions in which rainfall amount and distribution vary widely from year to year. Thus, for example, the Serer data are for an unusually bad year (Lericollais 1975), which was especially unfavorable for early millet (see S(2) on the figure).

The labor intensity of agriculture in West Africa (as measured in man-hours/ha) obviously varies widely between regions. Total hours worked/year by African cultivators

(Upton 1973:139) show an equally wide range, from 1600 hours/year in the cocoa zone of western Nigeria, to 400-900 hours (Malawi) or 855 hours (the Gambian peanut cultivators discussed above). In many cases, cultivators in northern regions with a relatively short agricultural season migrate during the dry season.

This section has given definitions of intensification accessible to persons observing a concrete situation, as well as to those with access to data on agricultural production and on productivity. Although field observation, cross cultural comparison, and examination of economic data can give an indication of "how intensive farming is" in a particular situation, the questions of where the system is moving, and what is its potential for change, can be answered only after a detailed consideration of the conditions surrounding the system. The case studies were designed to give an example of the kind of analysis needed of intensification in its ecological context.

The Semiarid Savannah

The main feature of the area we are concerned with are (1) enough rainfall to support agriculture distributed in a distinct wet/dry season pattern, and (2) savannah type vegetation with grasses predominating. As we will use the term here, the siarid savannah of West Africa (hereafter

often referred to as "savannah") lies between 10 and 15°N between roughly the 1100 and 300 mm isohyets and has 3 to 7 months with 50 mm or more of rainfall (see Figures 7, 9). There is a north to south gradient of most climatic factors in West Africa, which is reflected in vegetation bands, and, to some extent, soil types.

Environmentally this area is much more vulnerable to degradation than the forest area to the south, and is also the region where most indigenous forms of intensive agriculture are found. Because of its sparser vegetation and more level surface, it has often been seen as having great potential for supporting large scale irrigation and/or mechanized agriculture. Recent drought and accompanying food shortages in the area have brought it into world-wide attention. While the immediate international responses tended to be in the form of donation and distribution of food, there is also increased interest in long-term attempts at making the area agriculturally self-sufficient.

In this section we consider the physical and social environment of the semiarid West African savannah as it relates to agricultural intensification.

Rainfall is "undoubtedly the most significant climatic factor in Africa as a whole, as temperature has a relatively

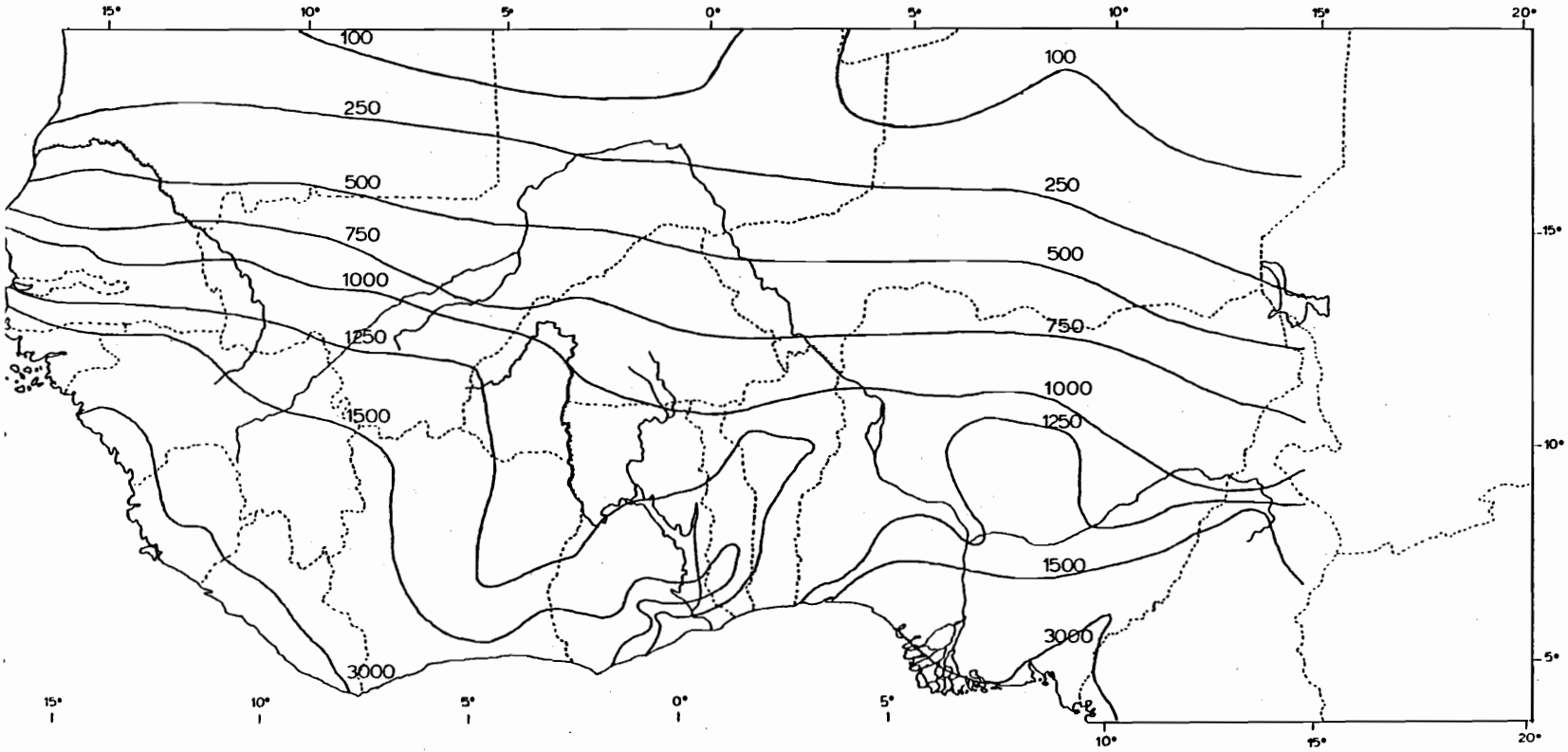


Figure 7. Average annual precipitation (in mm) in West Africa.
(Simplified from IFAN 1968.)

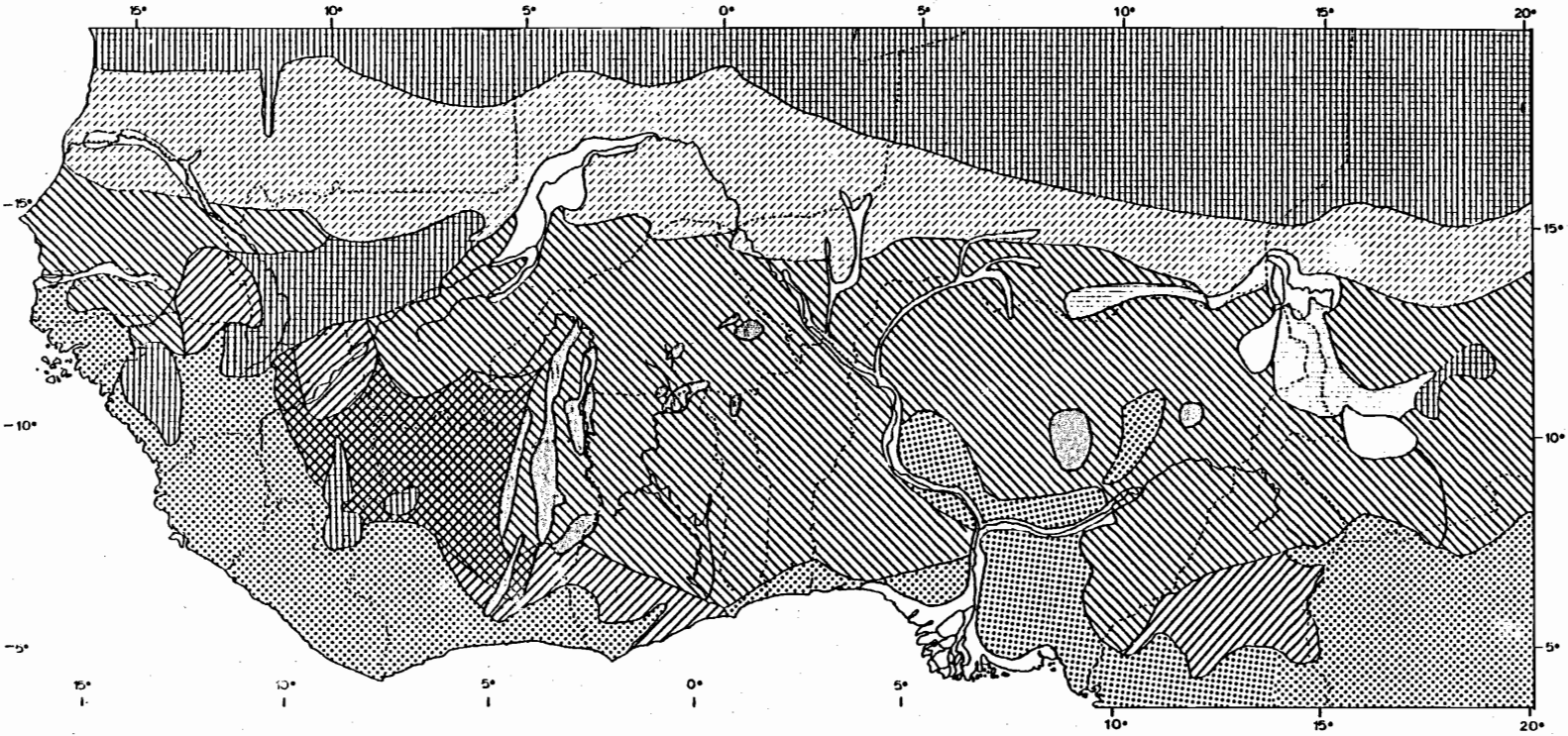
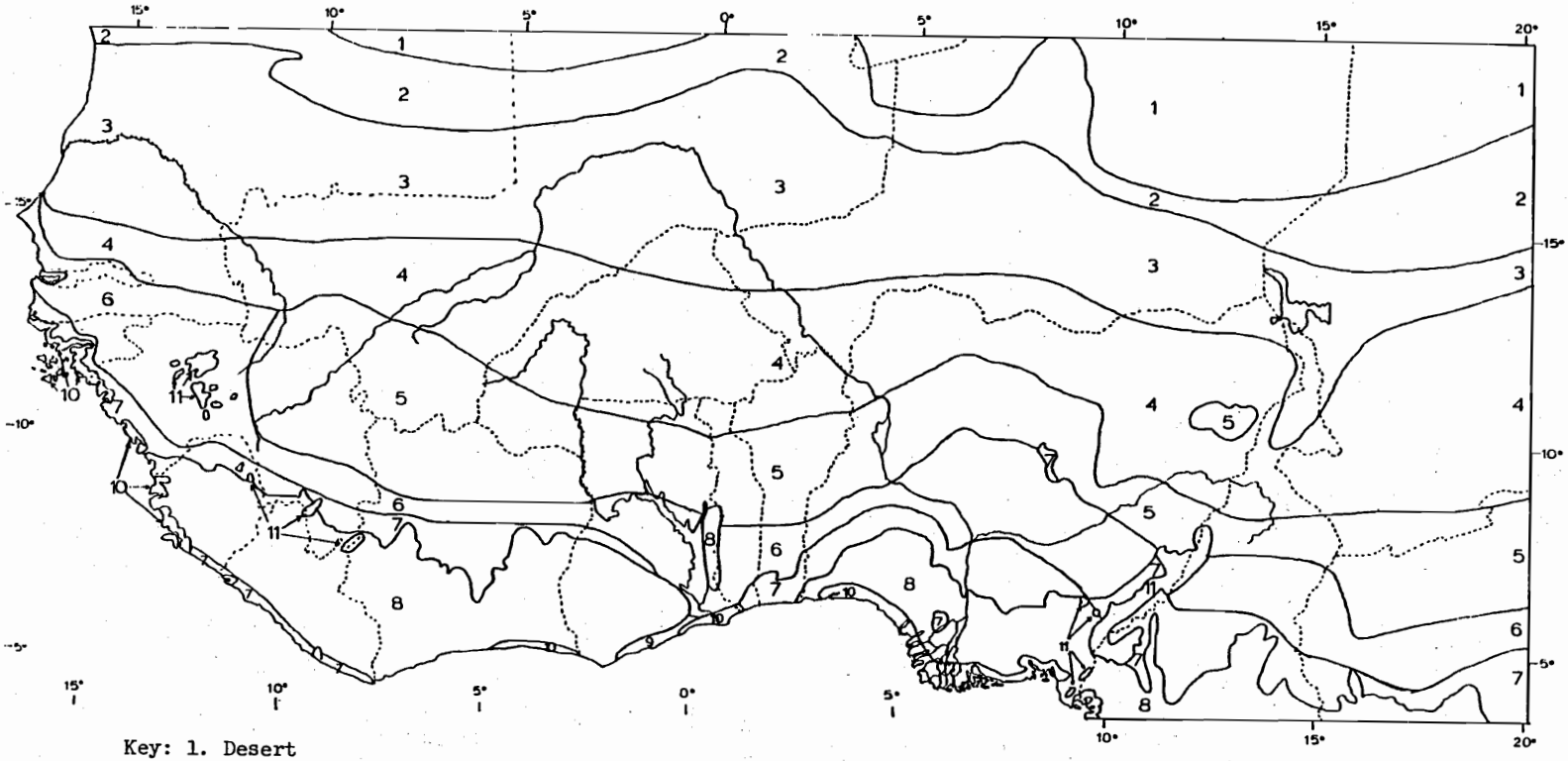


Figure 8. Soils of West Africa (simplified from D'Hoore 1964).



Key: 1. Desert
2. Subdesert steppe, tropical types
3. Wooded steppe with abundant Acacia and Commiphora
4-6. Woodlands, savannahs, and steppes
4. Undifferentiated: relatively dry types
5. Northern areas: with abundant Isoberlinia doka and I. dalzielii
6. Undifferentiated: relatively moist types
7. Forest-savannah mosaic
8. Moist forest at low and medium altitudes
9. Coastal forest-savannah mosaic
10. Mangroves
11. Montane communities

Figure 9. West African vegetation (simplified from Keay et al. 1959).

small annual range, and wind is generally of low speeds" (Griffiths 1972:7). Distinctive wet/dry belts show pronounced migration across the region associated with the north-south movement of the Inter-Tropical Convergence Zone (ITCZ), and the accompanying surface discontinuity (SD). To the south of the ITCZ is the humid maritime (Atlantic) air with winds from the south and west, and to the north of the zone is the dry continental (Saharan) air with winds from the east and north often carrying much dust (Griffiths 1972:168:69).

About 300 to 1300 km south of the SD the main precipitation occurs, but it is not continuous or even daily rainfall; rather it is short-lived with little cloud cover between (Griffiths 1972:169) so that evapo-transpiration is also high. Rainfall is associated with: (1) disturbance lines, which are belts of intense thunderstorms (sometimes called line squalls) moving east to west at about 30 - 50 km/hr, bringing first a strong wind followed by intense rain for up to half an hour, and then drizzle (ibid:173-74); and (2) local thunderstorms with widespread, variable, and sporadic rainfall.

Rains accompanying the SD move north into the semi-arid savannah in May and south out of the area in October. Their movement is not regular, however, but in a series of

latitudinal steps, showing a wide deviation both daily and from year to year (ibid:171). Thus the beginning and end of the rainy season are marked by great irregularity, which means that farmers must try not to plant until they think the rains will continue regularly. Sporadic rains at the beginning of the rainy season can mean replanting or loss of crops, especially the more drought-sensitive like early millet; at the end of the season when late grain varieties are heading, they can also affect yields. The heaviest months of rain throughout the area are July, August, and September, when the effects of the line squalls with their heavy winds are greatest, and can do much damage to standing crops. The thunderstorms are extremely variable in distribution over even small distances.

Temperatures in the semiarid savannah vary little, with a mean annual of 27 - 28°C, with highest temperatures just prior to rains in March, April, or May with extremes of 43 - 47°C. Lowest temperatures occur at the end of the rainy season with minimums of 7 - 9°C (ibid:196). With these high temperatures annual potential evapotranspiration is in excess of precipitation with ranges between 1600 and 2000 mm (ibid:199), with soil water surplus occurring in only a short period toward the end of the rainy season (Benneh 1973a).

The recent drought in the area has led to a search for possible causes with a view to prevention and prediction. There are two main ideas about causes of the drought: (1) anthropogenic degradation resulting from grazing and cultivating, and (2) change in rainfall patterns of either short or long term.

Pastoralists and agriculturalists tend to adjust to good years by expanding herds or areas cultivated, so that the most dangerous situation is a period of good years followed by a long drought when livestock destroy vegetation and tilled land is left exposed to the effects of wind and sun (Grove 1977, Swift 1977). This is what happened in the recent drought beginning in 1964. The increasing demand of growing urban populations for firewood and charcoal has also led to the deforestation of large areas (Grove 1977).

There is general agreement that human activity has played a role in the "desertification" of savannahs, and the advance of savannahs into forest regions, but there is also evidence for changes in amounts of rainfall (Shove 1977). Even though the recent drought was perhaps the worst since the 1830s, prolonged dry periods have been a common occurrence in the region for many centuries. These have not only affected rain-fed agriculture, but also those using

irrigation, for river levels also fluctuate dramatically. Among possible causes that have been suggested, changing pressure patterns are prominent, and a relation to sunspot cycles has been proposed. A number of precipitation cycles of varying frequency and amplitude may exist, and the present low rainfall being experienced could be part of a long term change that will persist for some time.

Most of West Africa is an immense but non-uniform plateau with elevations predominantly between 200 - 500 m. Elevated areas in the north and south delimit a central depressed area, which north-south plateaus divide into four basins: Senegalo-Mauritanian, Western Niger, Volta and middle eastern Niger, and Chad. The savannah region occupies the northern part of the southern elevation and much of this central basin area. It includes elevated plateau areas important because they have served as refuges, attracting high population densities, and for the intensive agriculture often practiced there.

The Senegal, Niger, and Volta are the main river systems draining the savannahs and their richer valley soils and water availability make them foci of agricultural intensification.

Different systems of western scientific soils classifications were developed under colonial governments in Africa

and applied to West African soils. Work up to that time was summarized and synthesized in a soil map of Africa in 1964 (D'Hoore). A simplified version of this map for West Africa appears as Figure 8. Classification is based primarily on the extent of weathering and leaching of soils and so the major groups are broadly related to climate and vegetation belts. Parent material is a secondary, though often agriculturally important, consideration.

In the semiarid savannahs of West Africa the following soils are the most important, and their relationship to agriculture will be briefly outlined (based on D'Hoore 1964, and Ahn 1970) in reference to the numbers used on the map.

1. Raw mineral soils and weakly developed soils. These soils generally have very little agricultural potential and are used mainly for grazing or extensive harvesting of tree crops such as gum arabic.

2. Brown and reddish-brown soils of arid and semiarid regions. Good structure and permeability, low organic content, usually in areas of less than 500 mm per annum. Suitable only for extensive grazing. Under irrigation can produce millet and cotton, but there is danger of destroying soil structure. Located immediately south of the weakly developed desert soils.

3. Ferruginous tropical soils. These are the most common soils of the semiarid savannah in West Africa. They tend to be developed over the richer Precambrian basement complex and often

contain appreciable reserves of weatherable minerals. They are fairly thin soils, seldom thicker than 250 cm, and very susceptible to erosion. Fertility is greater than the highly weathered soils of the wetter regions to the south, and they tend to respond well to fertilizers. These soils frequently show separation and concentration of iron oxides in mottled layers in the subsoil; when exposed by erosion they may harden irreversibly, drastically reducing productive capacity.

4. Eutrophic brown soils of tropical regions. These soils are not very widespread and the main reason for their separation as a mapping unit is their superior agricultural potential. Within the semiarid savannahs they occur primarily in northern Ghana, Upper Volta, and the Jos Plateau of Nigeria. They are rich in available plant nutrients with large reserves of weatherable minerals, developed over generally rich parent materials, and are generally well structured and permeable.

5. Hydromorphic soils. These soils, too, are not abundant in the region, but are important because of their agricultural potential, especially for irrigation. They are found along most streams and rivers, but only occasionally are extensive enough to be mapped, as in the Niger delta area of Mali and in the lower Senegal, Niger, and Volta valleys. They are much used for rice and sugar cane.

In general, the semiarid savannah soils are thin, "particularly low in organic matter and may have poor structures, poor nutrient reserves, and poor moisture-storage properties" (Ahn 1970:237). The main agricultural problems are water control and maintaining (or increasing) organic matter content. Under long periods of cultivation these soils are especially susceptible to sheet and gully

erosion and development of indurated layers near or at the surface (see above, ferruginous soils). Continued cultivation also decreases soil organic and mineral content (especially nitrogen and phosphorous) and leads to increases in weed and insect pests (Ahn 1970:244-45).

The above generalizations about savannah soils are of little use on a local level, whether for a development project or an individual farmer. They only give a broad indication of the possibilities for intensification, and knowledge of local soil conditions is essential to success in efforts to increase production.

The traditional method of maintaining fertility under cultivation is to shift fields under cultivation when production has declined to a certain point, clearing a new field and leaving the previous one to rejuvenate under natural fallow, which restores organic and mineral content and protects it from erosion and sun. Humus is important in maintaining soil structure, and is the most important factor making nutrients available to plants in savannah soils, and provides mineral nutrients as it decomposes. Fallowing also reduces insect pests and drives out weeds of cultivation.

In contrast to land cleared from forest fallow, that cleared from savannah fallow suffers a serious shortage of nitrate which lasts for one year, and may continue into the

second year. There are two reasons for this: the locking up of nitrogen reserves in grasses which are lost in burning during land preparation, and the inhibiting effect of some grasses, especially Andropogon, on nitrogen fixation by soil microbes (Vine 1968:105-7).

Burning is the subject of much debate, and is generally considered to be harmful, but there are some important positive aspects of the use of this important agricultural tool in the savannahs. Almost all sulfur and nitrogen are lost during burning, but phosphorous and potassium remain and are more immediately available. The alkaline nature of the ash also increases the availability of all plant nutrients. Burning may also have a partial sterilizing effect which increases supply of nutrients and inhibits growth of weeds. Exposure of the soil to the rain and sun causes increased oxidation of organic matter, destroys soil texture, and leaves the land vulnerable to sheet, gully, and wind erosion (Ahn 1970:242-43).

In the continuously cultivated fields that are important under intensive agricultural systems, the farmer seeks to duplicate the effects of the fallow by adding organic material to the soil, protecting it from erosion and sun, and controlling weeds by continuous hoeing. In maintaining fertility under more intensive systems the farmer may use animal manure, green manure, compost, or chemical fertilizers.

Animal and green manure and compost are valuable because of their slow rate of mineralization and addition of organic matter to the soil. Green manure also encourages soil bacterial activity and is important for maintaining soil structure (Vine 1968:100). Knowledge of fertilizer responses of savannah soils is limited and based on local experience. Available results from long-term experiments show strong responses to nitrogen, especially after a fallow period; little response to potassium; small to moderate but erratic responses to phosphorous, including millet and sorghum; good responses to sulfur by leguminous crops and cotton, but little response by cereals (Ahn 1970:266-269). Chemical fertilizers do not add organic content and do not prevent the decline in physical quality (and may even accelerate it). "It is doubtful if chemical fertilizers alone can maintain productivity on many West African soils if their physical properties decline" (Ahn 1970:245).

The accompanying map (Fig. 9) shows the major vegetation zones in West Africa, and is adapted from Keay (Keay et al 1959). In the semiarid area under consideration the dominant vegetation is a "Savanna," defined as "vegetation in which perennial mesophytic grasses...at least 80 cm high... play an important part; such vegetation is usually

burnt annually" (Keay et al 1959:6). Fire resistant trees are scattered throughout the savannah, being more abundant toward the south with increasing moisture availability. The whole area is probably a fire pro-climax, the result of centuries of burning, grazing, and farming by humans that prevent restoration of a 'natural' climax consisting of closed woodland with little grass.

To the north the savannah grades into steppe, a vegetation type in which the perennial grasses are less abundant, and annual grasses become dominant. It is far less liable to burning than savannah. The abundant Acacia and Commiphora of this zone become less abundant and of low stature further north as the next zone, subdesert steppe-tropical type, replaces it.

The savannahs contain abundant plant resources that have been used by the inhabitants over the centuries, some of which have been domesticated, including millet (Pennisetum spp.), sorghum (Sorghum), rice (Oryza spp.), cowpea (Vigna), bambara groundnut (Voandzeia subterranea), sesame (Sesamum spp.), and Hibiscus spp. (including okra and kenaf) (Irvine 1970).

A number of savannah trees have been traditionally used, and these are selectively left during clearing for agriculture. These include locust bean (Parkia clapertoniana --

seeds used to prepare a nutritious fermented cake), shea butter (Butyrospermum paradoxum -- seeds used to prepare a solid fat used in cooking, lamps, and skin care), baobab (Adansonia digitata -- leaves are an important source of food for humans and animals at the end of the dry season and beginning of the rainy season), and wild fig (Ficus spp -- leaves are used for animal fodder).

Rose Innes (1977) has described the process of change occurring in the stable fire pro-climax under cultivation for northern Ghana, and it is relevant to the rest of the savannah zone under consideration. About three years after initial clearing of the land, leaving only desirable trees, there is a decline in fertility and an increase in weeds, especially Striga spp., a parasite on millet and sorghum. Under a system of bush fallowing, the plot is then abandoned and felled trees regenerate from living stumps, with succession back to fire pro-climax being quite rapid, probably about 20 years. After many decades of increasing exploitation and decreasing fallow periods, none but selected trees survive, resulting in a parklike landscape with low status annual grasses, undergoing continual short rotation cultivation. At this point land essential for the maintenance of shifting cultivation or mixed farming (including rotated pasture for restoring

fertility) is no longer available. If pressure on the land continues, a "super-mature" parkland develops, with even the desired species of trees being lopped off or felled, and increasing soil exhaustion and denuding resulting in extensive soil erosion (Rose Innes 1977).

We have described the climate, soils, and vegetation with which the farmers of the semiarid savannahs are faced in their efforts to support themselves and their families. Farming is above all a family affair, and the longstanding bias in Western literature that sees the farmer as only the adult male head of the family is now realized to be erroneous. Women and children play very important roles in providing food, with men and women often complementarily specializing in different crops, tasks, or times of labor input. Young children are especially important in taking care of the animals, a task that requires relatively little energy expenditure or skill. The roles of women and children in the fields themselves become more important with increasing intensification of agriculture, with more labor intensive methods, and less time spent on the very heavy labor of clearing new fields from bush.

The great ecological bands that run from east to west across West Africa have influenced the development of human activity. In the arid north are pastoralists, a

thin population of humans and animals on relatively poor soils. Going south, the importance of herding tends to diminish and to be replaced by agriculture in the savannahs as the growing season becomes longer and the water availability increases. Millet, sorghum, and groundnuts are the most important crops. Population densities increase, but not uniformly. Population density tends to be concentrated on the most fertile soils, and this is where intensive agricultural systems have developed. Further south into the forest region, resources for agriculture become more abundant, and high population densities are supported primarily under extensive cultivation of root and tree crops.

Tools of the savannahs are the hoe, cutas, and fire. The use of iron may have been introduced into the area from across the Sahara about 2500 BP and undoubtedly has had an important effect in allowing increased production (Goody 1971). There is no tradition of plows or wheeled vehicles, but even without complicated tools, the people of the semiarid savannahs have developed an agricultural system that is adapted to making a living from this very formidable environment.

A wide variety of naturally occurring food resources are known and exploited, and although they tend to be used

less and less with the development of more intensive agriculture, they always form a reserve in times of hunger. The main crops of the area are the millets and sorghums; a large number of varieties are adapted to the growing season and water supply at the various latitudes of the semiarid savannahs.

The prevalence of infectious disease in Africa is very high, and that the people there "labor under a heavy burden of sickness in everything they do is beyond question" (Hughes and Hunter 1970:445). Some of the most important infectious diseases in the semiarid savannah of West Africa are trypanosomiasis (sleeping sickness), onchocerciasis (river blindness), schistosomiasis (bilharzia), malaria, dracuncluliasis (guinea worm), intestinal parasites, cerebrospinal meningitis, measles, and leprosy.

Malnutrition, primarily protein-energy malnutrition (really <u>under</u>-nutrition, PEM) is widespread in Africa, and is especially prevalent in the semiarid savannahs of West Africa (Bengoa 1975). The statistical evidence is fragmentary, but such surveys as have been done, and information from hospitals and clinics, show very high rates, especially among young children. This malnutrition interacts synergistically with infection to increase the morbidity and mortality that would result from either one alone (Scrimshaw, Taylor, and Gordon 1968).

Kwashiorkor, or severe protein undernutrition, was first defined in southern Ghana and the idea of relative protein deficiency in African diets has had wide popularity until recently. It is now being realized that in areas like the savannahs where the staple food (grain and legumes) is high in protein, the problem is not one of protein deficiency, but of total food deficiency, i.e., if enough calories are available, then adequate protein will be supplied.

Before the 20th century, West Africa was probably the most unhealthy region of the world and had the highest death rates. Only high birth rates sustained population numbers. Death rates have been greatly reduced since the beginning of the 20th century, though still among the highest in the world. Fertility rates, however, have not fallen significantly, and they, too, remain among the highest in the world, with potential demand for contraceptives among the lowest internationally. While much of West Africa remains rural, the rate of urbanization is again among the highest in the world (Caldwell 1975a). These developments, along with a high incidence of migration, indicate that West African population has undergone major changes in this century and these have had an effect on society, agriculture, and economics.

Within West Africa there is a contrast between the coastal areas and the interior savannahs. In the latter, population densities and growth rates are lower, partly as a result of a harsher environment, higher mortality and lower fertility, and higher emigration. Yet the direct impact of modernization is less, and the desired family size tends to be larger while demand for contraceptives is lower.

The fast growing populations of the savannahs are characterized by a large proportion of children so that the ratio of consumers to fully self-supporting producers is high. Thus the population pyramids tend to be broad-based, narrowing rapidly toward the older age groups. Population pyramids are illustrated in the case studies. Migration has the effect of distorting the age structure of populations and this, too, is reflected in the pyramids. Because the savannah areas have been labor reserves for the forest and coastal areas to the south since the turn of the century, there tend to be fewer males than females in the 15 - 45 year age group.

It should be mentioned here that increasing population tends to absorb national resources in the provision of services such as education and medical care, diverting them from capital investment to increase production. This

may slow economic development so that the effect of modernization on decreasing fertility may be long delayed. There is even some evidence that modernizing trends may tend to increase fertility. For example, in some West African countries urban fertility appears to be higher than rural fertility. Nomads and women in polygynous marriages have lower fertility than sedentary agriculturalists or monogamous women, and as sedentism and monogamy increase, they may operate to increase fertility (Caldwell 1975a).

The unilineal descent group forms the basis for social organization for some of the centralized states as well as the acephalous chiefless or segmentary societies of the savannah. Unilineal means that descent is reckoned in only one line. In the savannah this is the father's line, hence the term patrilineal descent groups. Clans are usually groups of lineages whose common ancestry is not demonstrable and often mythological. All members of the lineage are considered to be legally equal, and descent is basically a jural concept that forms a connecting link between internal domestic and external political and legal relations. The lineage acts as a group in defending its territory and settling internal disputes (Fortes 1953). Its unity is often symbolized by religious ritual centered around ancestor worship. There is a strong tie to the

land of the ancestors, but the lineage itself is not tied to a locale, and there is abundant evidence that farmers will leave their homeland to take advantage of economic opportunities elsewhere.

In state level societies, kinship may be somewhat less important and membership in an ethnic or occupational group may be emphasized. Political relations reflect a hierarchy in which government officials or wealthy land owners have a larger role in making policy and enforcing the laws. In such societies, economic stratification and patron-client relationships are often significant. Islam as the dominant religion in most areas admits members universalistically without reference to prior kinship ties or ethnicity.

We use the terms 'family' and 'household' interchangeably in this paper to mean the domestic group that functions as a unit of production and consumption. In most of the savannah area polygyny (a man having more than one wife) is considered the cultural ideal, and is made possible by the younger ages at which women marry. A household can thus include a man and his wives and children. At a later stage it might include in addition the married sons and their wives and children. When the father dies there is a tendency for the household to break up into smaller households, first along lines dividing full from half brothers. Groups of brothers might also continue living

and farming together. Thus there are several stages in the development of the family that can influence the incentive or ability to intensify.

Trade in the savannah area has a long history and has provided contact between the Arab desert peoples to the north and the forest dwellers to the south. Colonialism changed this around, orienting trade toward the coast and de-emphasizing the east-west routes that existed. Africa was seen as a source of raw materials and cheap labor, and slaving was encouraged in the interior savannahs. Later development of export agriculture, mining, and increasing government activities along the coast led to recruitment of forced labor in the savannahs, and establishing a trend of emigration, both seasonal and long term, from these areas that continues to be a major factor affecting agriculture today.

A dual society grew up in the coastal areas and in interior capitals with African elites adopting much of the life style and material wants of the Europeans. After independence these elites formed the governments and saw as their political base not the rural farmers, but the increasingly large urban populations who were learning to want the same things as the elites. Post-independence development projects have tended to extend colonial patterns

with an emphasis on large scale industrial projects in the cities and export oriented cash cropping in the rural areas to support industrialization and, more immediately, the western lifestyle of the elites and urban dwellers. An important aspect of this policy has been keeping prices paid to farmers for food and cash crops low to supply urban dwellers with inexpensive food and to increase the government's profit on exports. This has worked against increasing production in the rural sector. When these programs failed, as almost all of them did in their own terms, blame is often put to the economic backwardness of the rural farm family.

Explanations for Agricultural Intensification

Agricultural intensification, or the lack of it, is often "explained" by certain factors in the physical or social environment of a human group that stimulate the practice of certain new techniques or that interfere with their adoption. Such explanations may be based on implicit assumptions about human nature, inherent traits of ethnic groups, or the way in which revolutionary social change takes place. In many cases they result from after-the-fact attempts to understand why a seemingly beneficial innovatio has not caught on or why a well-funded project has failed.

Social scientists may dignify their explanations as hypotheses or models, but it is not necessary to adopt an arcane vocabulary or a specialist approach to see certain persisting patterns of explanation and to test them objectively against real cases of intensification in West Africa. We will consider in turn explanations that focus on cultural predispositions, environmental constraints and options, technological change, population pressure, economic incentives, and political or governmental activities. These different viewpoints for evaluating the process of intensification are plainly not mutually exclusive, but we will attempt to clarify their interaction in particular ecosystems and to suggest their relative importance in situations of change.

Resistance to more intensive methods of crop growing is often credited to the cultural background of the people concerned. Because ethnic groups in Africa are often quite distinctive with an identifiable language, dress, settlement pattern, and subsistence system, it is easy to characterize a "tribe" as having ingrained attitudes toward work, shared personality features, and social customs that take precedence over economic calculations. Because a cultural group has survived from the past and lacks written history, it is presumed to be slow changing, traditional,

and conservative. Frequently the peoples' own explanations of their behavior support this stereotype. When asked why they do not adopt a new practice, they may cite the ritual timing of their old agricultural calendar, a religious attachment to the land and graves of their ancestors, or customary bars to men or women doing certain kinds of work. Such explanations may emphasize the persistence of ideal behavior and neglect changes that are indeed taking place. A certain practice, regardless of how it is rationalized, may actually be economically adaptive for the farmer. Practical decisions made by the small-holder over time cannot threaten his subsistence, and it has long been demonstrated that people respond to obvious economic opportunities, even when these seem to run counter to certain cultural values (Schultz 1964).

When agricultural intensification is not vigorously pursued, outside observers often cite a lack of motivation and behavior which one expects in a western market system. People are said to be incapable of seeing that a new tool would raise their efficiency, or that devoting all their labor to one high-value crop would maximize their returns. They are said to value leisure highly and to work only long enough to acquire the cash for some limited goal. Wealth that they acquire is dissipated, going into increased

consumption, or bridewealth, or used to support parasitical relatives, rather than being productively invested in their enterprises. These assertions can be contradicted by the evidence of people working harder and longer when the rewards justify it and altering residence, marriage patterns, and household arrangements in order to maintain or increase their incomes (Sahlins 1957, Netting 1965, Basehart 1973, Hanks 1972). Where maximization of production or income is absent, it is often found that the farmer is protecting himself against climatic fluctuations or market gyrations and assuring the food supply of his family under conditions of considerable risk (Wharton 1971). Cultural predispositions are indeed present, and they may affect the rate and direction of agricultural change, but they do not form a rigid shell warding off all innovation. Only when the costs and benefits to the individual of more intensive farming can be realistically evaluated can the supposed maladaptive influences of traditional culture be assessed.

It often appears that the traditional social groups organized around production or consumption impede the changes necessary for agricultural intensification. It is true that large communal work parties composed of a lineage or an extended family household may be effective in tasks such as clearing or weeding the relatively large fields under

shifting cultivation. On the other hand, a small group such as an independent nuclear family may provide all the labor necessary for the limited, manured plot that is kept in annual production by the continuous attention and fine-comb techniques of the gardener. Similarly a big residential unit with a number of adult workers under the leadership of a headman can practice a diversified agriculture on widely dispersed plots along with a variety of secondary occupations, pooling its crops and earnings to provide a secure subsistence for the whole group. Where land is concentrated and confined, increased effort may be elicited if each nuclear family is responsible for its own needs and can seize new economic opportunities without waiting for the approval of a corporate group and without sharing the proceeds of a successful endeavor. The size and composition of households and kin groups seem to be significantly related to the kind of agriculture being practiced, but this does not mean that the organization customary at any point in time is fixed and resistant to change. In fact, there is evidence that large extended family compounds of Ibo broke into constituent family units living separately as land shortage brought about the transition from shifting to intensive cultivation (Udo 1965). When the Kofyar of the Jos Plateau in Nigeria moved from the densely populated

hills to the free land of the plains, they not only took up bush fallow agriculture but expanded the household work force by marrying more wives and keeping married sons at home. They also began to hire labor for the first time (Netting 1969). It would seem, therefore, that such cultural features as family structure and work group organization are more flexible than had been thought, and that they have the capacity to adjust to alterations in the environment and to changing labor needs. These changes take place with little feeling among the people concerned that they are breaking cultural rules or denying social values, and they result from individual decisions as to when it is advantageous to marry or where one can best set up housekeeping. Such choices are not culturally unconstrained, but over time they are responsive to economic variables.

Customary law is frequently seen to be in direct opposition to agricultural development in the area of land tenure. Many westerners carry with them the conviction that African communities held resources in common and that private property was absent. Again, the stereotype may fit shifting cultivation where individuals had rights only to the crops they grew and not to the land which was a communal possession allocated temporarily to families according to need. On

the contrary, when land is too rare to be fallowed regularly, when it has been improved by fertilization, irrigation, or terracing, and when it has the potential to support tree crops or other kinds of permanent production, it becomes too valuable to revert to the group. People who must compete for land and farm it intensively develop continuing rights to it, first the right to pass it on to their heirs and then progressively more inclusive rights to loan, rent, and finally sell it. People in the same village may have some of their territory in individual tenure and the rest as a communal holding, but these contrasting bundles of rights reflect different kinds of land use. As the agricultural systems change and land acquires value, tenurial practices adjust, often in a spontaneous and almost insensible manner. They may be recognized in litigation and legal precedent long before either customary or statutory law includes them. This gradual process may be preferable to the attempt to institute individual rights in land as a way of hastening intensification which is like putting the cart before the horse. There may indeed be conflict between villages or ethnic groups with different types of land use. Communal rights may be asserted over presently unused bush in an effort to prevent its appropriation by outsiders who wish

to bring it under permanent cultivation. In effect this requires a decision by external authorities, not just over the legal status of the disputed property, but over the most desirable use to which the land can be put.

Though no one should expect a painless or automatic transition in the socio-cultural factors of household and village organization of land tenure rules, it seems apparent that these institutions show some degree of correlation with agricultural systems and that individuals, when given a choice, may act so as to bring about change that adjusts their social behavior to an altered set of ecological constraints and options.

An area like the Sahel, much of which has marginal rainfall and a high potential for disastrous drought, would seem to lay primary stress on physical factors in determining the limits and possibilities for different agricultural techniques. Where precipitation is erratic and crops have no alternate sources of moisture, the use of fertilizing, extra weeding, or terracing on uplands might be wasted effort. Uncontrolled flooding of lowlands might be equally dangerous, and the presence of ironstone caps or red clay soils that are difficult to work when either wet or dry would seem to decisively hinder cultivation in certain areas. Geographers and agronomists have often used

soil classifications to indicate the limits of permanently cultivable land and the fallow periods necessary where only shifting cultivation could take place (Allan 1965). This view is not environmental determinism but it has been called "possibilism" and it does purport to establish the environmental limits on the agricultural potential of an area (Netting 1974). Both the presence of indigenous intensive agriculture in many places (Fig. 1, Jos Plateau, Mandara Mountains, northern Ghana savannah, inland delta of the Niger, Bandiagara escarpment) and the recent extension of permanent cultivation over wide areas (fertilized infields in Hausaland) indicate that environmental factors may be less narrowly restrictive than had been thought. Carrying capacity may be limited under certain technologies, but the more favored parts of the Sahel may still afford opportunities for productive intensification. Though little further production can be expected from lands already supporting 700 to 900 people per square mile, human efforts at increasing fertility through organic and artificial manures, crop rotation, irrigation, and more frequent working of the land can substantially increase the yields of large areas still in bush or under long-fallow cultivation. Forest clearance can eliminate tsetse fly and lessen the danger of cattle and human disease.

Environmental limitations are, therefore, not absolute but relative. For each set of climatic, edaphic, and topographic features, there appear to be several intergrading systems of land use possible. Where low precipitation means frequent crop failure, only nomadic herding may be possible, but at higher rainfall levels, a range of shifting and intensive agricultural systems may exist (Porter 1965). Empirical analysis may give the gross outlines of what is agriculturally feasible, but the more relevant question is whether production may be significantly increased by local efforts using methods for intensification already present in the society. If people can maintain permanent gardens, even for small quantities of secondary crops like kitchen vegetables or tobacco, then the environmental potential may be present for an expansion of intensive cultivation. The types of land chosen for such activities in terms of soil qualities, vegetation, slope, and distance from settlement, may indicate the most promising conditions for the process to take place. On the other hand, evidence of soil exhaustion, erosion, and localized depopulation may indicate the passing of an environmental threshold beyond which intensification cannot take place, given the technology and knowledge to which resident farmers have access. Environmental factors, considered in isolation, may set broad limits for exploitation,

but in better watered parts of the Sahel savannah, they neither create nor prevent intensification. Workable soils of adequate or improvable fertility and access to sufficient water at the proper intervals for crop growth are necessary but not sufficient conditions for intensive cultivation.

The intensification of agriculture is often thought to be synonymous with the conversion of farming from manual labor and simple tools to non-human energy sources and complex mechanical devices. Both westerners and educated Africans frequently accept the technological revolution that reduced labor and simultaneously increased production as a model of what the Third World must do. We must ask if such a change is the same thing as intensification and to what extent it is economically feasible in Africa. Intensification as we have defined it involves the permanent use of land in such a way that yields are sustained without environmental degradation. If this result can be achieved with a digging stick on a flood plain or by tractors and combine harvesters, it is still intensive agriculture. Indeed, certain types of intensification such as the oriental method of hand transplanting wet rice may achieve higher production than motorized methods and be applied in spaces too cramped for effective use of power tools. Many African

societies use the same simple home-made tools such as the hoe and sickle in both shifting and intensive cultivation and bring to each the same physical skills and repertoire of crops. Where shifting cultivation is dominant, it is not because people lack knowledge or aptitude for permanent cultivation but because, for a variety of reasons, intensive cultivation is less efficient in meeting their needs.

New tools, and in this we include such other inputs as improved seeds, manufactured fertilizer, pesticides, and herbicides, undoubtedly save labor, but are they therefore more efficient? Making and using them consumes large amounts of fossil fuels. When this energy source is cheaper than human or animal labor, it is preferred. When fuels are scarce and expensive, costs of production rise to the point where renewable people and draft animals may be cheaper (Pimental 1973). In a largely subsistence economy, the capital for even minimal technical innovations may not be present. Since plows and ox teams conserve labor, they may be used to bring new land on the settlement frontier into cultivation rather than to substitute for hand methods on smaller plots where labor is plentiful. Thus even intermediate technology may operate to <u>de-intensify</u> agriculture, decreasing yields per unit land while increasing total production. The invention and diffusion of

agricultural technology is thus not equivalent to intensification nor is its desirability always high and constant. Availability of land, costs of labor and capital, susceptibility of specific crops to increased productivity, and market outlets for agricultural surpluses may all influence rural technological change. It may well be that the cost/benefit ratio may be highest for relatively small developments such as improved crop varieties and fertilizers that can be acquired cheaply and integrated easily in existing systems of cultivation. High-energy mechanical technology on the Western model may be an illusory goal that delays or diverts the course of local intensification.

Perhaps the most influential explanation of agricultural intensification to appear in recent years is the hypothesis of Ester Boserup. She sees increasing population density in rural areas as a major causal factor reducing the time that land can remain fallow and promoting systems of permanent land use. Instead of the conventional Maltusian sequence beginning with the invention or diffusion of new agricultural techniques making possible increased production and permitting population growth, Boserup (1965) suggests that the process is actually reversed. If local population density goes up for any reason, people must find ways to raise the production of each unit of land. The other crucial

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component of the Boserup model is her recognition that intensification has a cost -- in terms of output per unit of labor, it may be less rather than more efficient. Shifting cultivators make little investment in tools, use fire to clear trees, fertilize the soil with ashes, and kill weeds and insect pests. They often do not turn the soil at all, and their annual work expenditure is relatively small. In contrast, more intensive farming requires greater land preparation, soil conservation techniques such as ridging, terracing, and ditching, fertilization that may depend on tending domestic animals that produce manure, increased weeding and field guarding, and water control such as irrigation or drainage. There is now little doubt that intensive agriculture requires the average farmer to put in more hours of labor over the course of a year than does shifting cultivation (Hanks 1972). For the scarce resource of land, the farmer substitutes labor. The costs of this trade-off make understandable the reluctance of many long-fallow cultivators to adopt intensive methods. Though farmers may not calculate hours of work and exact yields, they make economically rational choices, and the best general rule for predicting their behavior is that they "work to get the maximum return for the minimum effort" (Nye and Greenland 1960). Therefore, "practices of extensive

agriculture are normally adhered to until population pressure becomes such that the system ceases to be viable through lack of sufficient land for rotation" (Dumond 1961).

Simply stated, the Boserup explanation claims that increasing population density will force more frequent cropping of land, higher production per unit land, and an increase in labor input. The process of intensification is visible in decreasing amounts of fallow land, smaller farms, higher and more sustained yields, and the application of ever greater amounts of energy to each unit of land. Regional studies in West Africa have demonstrated again and again that population density correlates with agricultural systems in a regular manner with low density groups practicing shifting cultivation, higher densities engaged in rotational bush fallowing, and semi-permanent or permanent agriculture maintained under high densities (Gleave and White 1969, Udo 1965, Benneh 1973b, Netting 1969). The threshold for transformation to an intensive system in the Sudan zone may be a density of 200 to 250 per square mile, though this is subject to local environmental conditions (Prothero 1962).

What factors modify this postulated connection between population pressure and land use? Boserup does not specify why population should grow but merely suggests what happens when it does. The same effect would be produced by any

change in man/land ratio, e.g. by demographic growth through increased fertility or declining mortality in a circumscribed area, by in-migration, or by a shrinking land base due to losing part of an area to competitors or alternative uses. The process of intensification itself may further stimulate population growth as higher and more stable levels of food production are achieved. According to the model, however, if the density of population is relaxed, people may revert to less labor-intensive shifting techniques (Boserup 1965:65). An apparent technical regression took place when Europeans colonized a sparsely settled southern Brazil or when Kofyar terrace farmers moved into a nearly vacant savannah area and took up slash and burn techniques (Netting 1968). In both cases, people with the knowledge and experience of intensive methods abandoned them because they no longer needed to economize on land and because they opted for larger returns on labor. It is true that once a complex irrigation system or an area of fenced and leveled farms has been established, people may maintain it even in the face of falling population (Brookfield and Hart 1971), but the overall co-occurrence of population density and agricultural intensity appears to be supported. Moreover, demographic growth seems to initiate the logic of intensification because it limits the ability of rural food producers to subsist by less demanding means.

We have been discussing intensification as if it took place in an artificial universe where local groups provided for their basic subsistence as influenced by existing environment, technology, and population. In fact we know that almost all rural people today are involved in both regional and global economic networks, and that their choices of how to farm and whether to farm or follow alternative occupations are influenced by conditions in the market place. It is also clear that farmers are shrewd judges of profitability, putting land and labor into those crops that fetch a good price and rapidly switching away from products on which returns have declined. Given this practically universal eagerness to participate in market exchange, can economic factors alone trigger intensification? This may depend on a set of other ecological variables. If there is market demand for a crop that can be grown by shifting techniques and if land is plentiful in relation to labor, increased production will take place by extension of the farmed area. If the crop demands a resource in short supply, such as the water required for irrigated rice, or if special practices are needed, as in the transplanting and fertilizing of tobacco, the introduction of the crop demands intensive means, regardless of the man/land ratio. Under such circumstances, there

may be selective intensification of cash crops while subsistence foods are cultivated by traditional shifting techniques. Intensification may spread to the rest of the farming system only if the other factors of population pressure and resulting land shortage are present. Even where a cash crop is currently profitable, however, farmers may be reluctant to rely entirely on it, preferring to maintain the subsistence insurance of home-produced food as a hedge against the uncertainty of market prices.

Economic factors emerge most clearly in relationships between distance and intensity of agriculture. Farmers characteristically practice the most intensive methods, e.g. the kitchen gardening of vegetables, in plots nearest to their residences where travel time for the frequent visits to tend, manure, protect, and harvest, is minimized. Zones at greater distance from the homestead are characteristically cultivated with declining intensity. Similar land-use rings may be seen surrounding settlements. Markets also set up spheres of attraction within which certain products may be produced mainly for trade. The farther one is from a city, the greater the cost of transport and the more the risk that perishable products like fresh vegetables or fruit will not arrive intact. An urban market is both

a dependable outlet for food, condiments, fibers, and other raw materials and a source of the necessities that more specialized farmers do not produce for themselves. It is pointless to argue whether large centers attract population or dense populations crystallize into market-based towns and cities. The fact is that peri-urban areas are characteristically more densely populated than the hinterland, that high demand and low transport costs encourage intensive use of scarce resources such as land, and that market exchange rewards both specialization and year-round production. The fine-comb methods and multi-cropping of the truck gardener are typically found in close proximity to market centers.

With the extension of market inducements along rivers, roads, and railroads, allowing cheaper transport and ease of communicating economic information, the conjunction of higher population density and agricultural intensification may radiate into the countryside. Migrants take up land near roads, and land develops a scarcity value. Building sites compete with agricultural uses, and the familiar cycle of high land prices and the need for increased, constant agricultural returns begins. Over large areas of West Africa, economic development is based on cash cropping. More land is taken into cultivation,

and there is also a premium on increasing output per acre. Increasing the land requirements of the community lowers the critical population density and at the same time hastens the same agricultural changes that are also contingent upon increasing population density (Gleave and White 1969). The spread of cash cropping and population growth are practically inseparable as causative factors, but it is safe to say that intensification will proceed most rapidly when both are present, and that cash cropping without dense rural populations is less likely to employ intensive means.

Because economic development implies the diversification of opportunities to make a living outside of agriculture, there is no simple one-to-one relationship between increasing population density and intensification. With shrinking land resources, small holders may decide to work as part-time craftsmen or traders or they may seek seasonal wage labor in their own communities or abroad. Wives may find cottage industry more lucrative than farming, and unmarried sons may get jobs in the city and send remittances home. The choice is not whether or not to participate in the market economy, but whether more intensive agriculture is the most profitable way to do this.

Regional comparisons in which factors of physical environment and population pressure are held constant show that core areas near large market centers follow the course predicted by Boserup, producing food and raw materials by means of permanent cultivation. Peripheral areas, on the other hand, make up the short-fall from traditional shifting cultivation by sending migrant wage laborers to distant plantations or mines. With cities less accessible and transport costs high, farmers from the hinterlands cannot compete effectively. Rather than make expensive, long-term investments in terraces or soil improvement, they can achieve more immediate economic benefits by selling their labor (Smith 1975). Where intensification is not a response solely to subsistence needs but also to market demand, it may reflect local differences in purchasing power in addition to demographic factors. The economic model requires consideration of a variety of economic strategies, of which agricultural intensification is one, and an effort to assess the relative rewards of each.

All of the factors we have been discussing may be affected both indirectly and directly by the actions of national governments and international organizations. Development in the agricultural sector and particularly

the intensive production of cash crops for the world market was approached during the colonial period by expansion of the transport and marketing infrastructure, by eliminating warfare and unsettled political conditions that interfered with commerce, and by imposing taxes that forced people to sell products or services. Colonial conditions probably stimulated both population growth and economic activity, thus contributing both push and pull factors to the intensification of agriculture. Since World War II, in the closing years of colonialism and in the new independent states of West Africa, large planned projects or schemes have also attempted to change cultivation directly, introducing modern, high energy technology to irrigate, plow, and harvest cash crops by means developed in the West. Stepped-up scientific efforts were devoted to coping with local environmental conditions through the breeding of new crop strains and experiments with different fertilizer applications, crop rotations, and soil characteristics. In many cases it was assumed that the dissemination of scientifically proven new crop varieties and methods along with a labor-saving technology would produce such immediate and obvious benefits that they would be rapidly adopted. Dreams of a Green Revolution often went unfulfilled, however, and intensification often proceeded by traditional methods

outside the projects rather than within them. By establishing projects in sparsely populated areas, seeking to limit economic alternatives for workers, and favoring expensive mechanical solutions over intermediate technology, governments often neglected the incentives to intensification present in both man/land ratios and private profitability. Where elaborate plans have not borne the expected fruits, there is always the tendency to blame single factors -- the intransigence or ignorance of local ethnic groups, a poor rainfall regime, ineffective agricultural extension, or the lack of capital and trained personnel to keep equipment running. Propaganda for the new techniques and exhortation of the farmers was sometimes replaced by subtle forms of coercion in requiring the repayment of agricultural credit or forcibly claiming a part of farmers' harvest. While believing that indigenous agricultural intensification took place in the past and continues spontaneously today and that governments have enormous powers to assist or hinder this process, we wish to suggest that the process involves a variety of factors in complex systemic interaction, and that not all of these are subject to direct manipulation from the outside. Since we are not discussing the type of intensification achieved by highly capitalized and tightly administered agribusinesses

or state farms, we will be most concerned with the variables affecting the cumulative decisions of small farmers in the light of their own material best interests. There is no automatic assurance that such decisions to make agriculture more permanent and more productive will always coincide with the goals and the priorities of the state.

Case Studies

The purpose of the case studies is to present the range of factors influencing intensification in a given situation, and to show how these factors might change through time. Each case study is in turn representative of types of intensification related to possible casual factors. We are not trying to set up a typology, but merely to suggest associations, possible causal relationships, and to evaluate application of the models presented in the previous section.

The first case is that of the Kusasi of northeast Ghana, which is representative of rural rain-fed agriculture in densely settled areas. Next we will deal with the Hausa of northern Nigeria as representative of various degrees of intensification, including permanent cultivation near large traditional cities. The last case, representative of irrigation agriculture, is the interior delta of the Niger River in Mali, where rice is the major crop.

The Kusasi of Ghana. The Kusasi are a group of about 250,000 people living mostly in the northeast of Ghana, with smaller numbers across the borders in Upper Volta and Togo. This homeland is called Kusack. Significant numbers of migrant live further south in Ghana, especially in the cities and cocoa growing regions, and there is more and more of a tendency for them to become permanent residen there.

Their language, Kusaal, is one of the Mole-Dagbane languages. Along with other tribes in this group they form a culturally homogeneous area in Northern Ghana and Upper Volta (see Fig. 10). Within this area, where millet, sorghum, and peanuts are the main crops, it is northeast and northwest Ghana that the most intensive rain-fed agriculture is practised.

The Kusasi system will be presented as an example of intensive agriculture. Much of the discussion is based on preliminary analysis of information gathered during field work in one village of about 2,100, here referred to by the pseudonym of Tenga. (This field work was done by Cleveland from October 1976 to March 1978, and was supported by a grant from USAID to the University of Arizona). All the people were Kusasis with the exception of seven families of Fulani who specialize in cattle herding for other villagers. Some information on the other

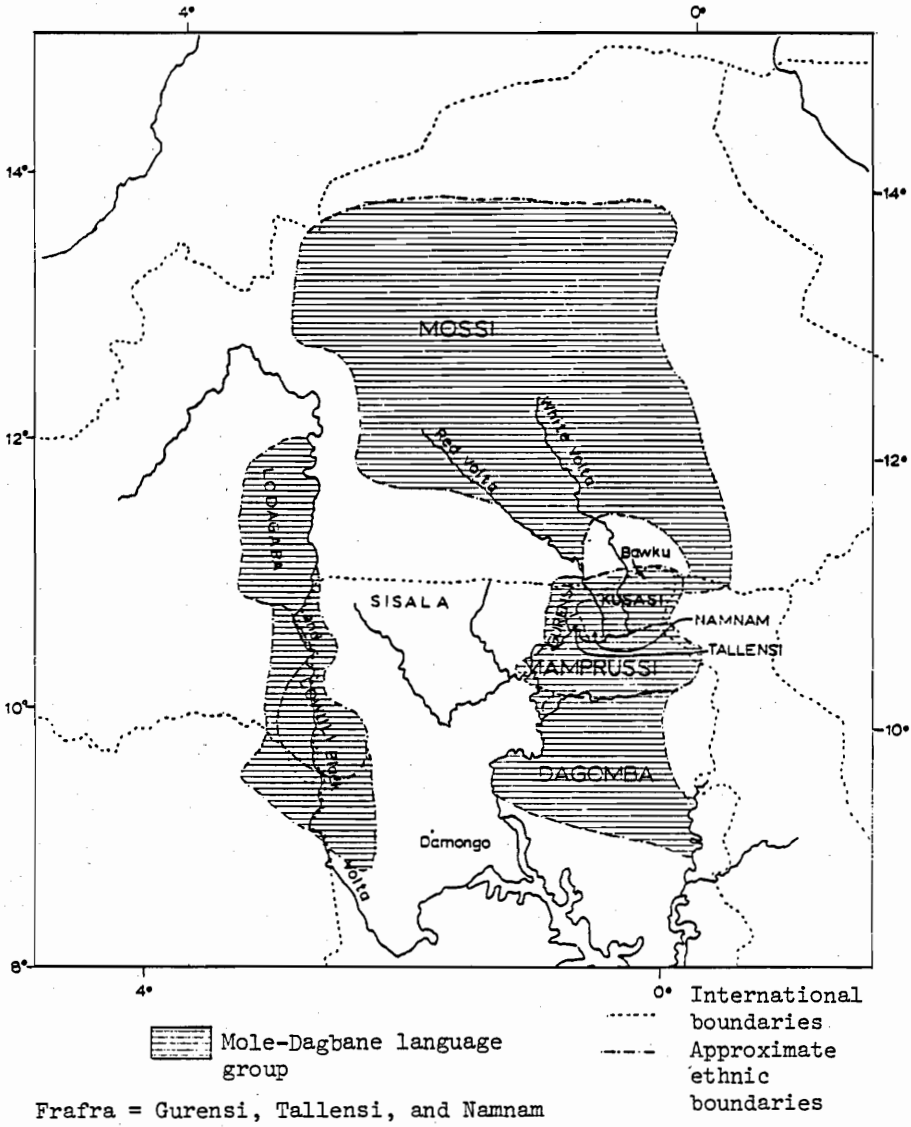


Figure 10. Location of the Mole-Dagbane area in Upper Volta and Northern Ghana (from Fortes 1945, Goody 1967, Hunter 1968).

intensive farmers in northern Ghana (Tallensi, Frafra, Namnam, LoWiili, LoDagaba and Mossi) will also be presented. In addition, comparisons will be made between intensive farmers as a whole and the more extensive farmers (Mossi, Mamprussi, Sissala) in the area.

Prehistoric population movements in West Africa are little known, but the Kusasi and related groups have legends about origins to the east,in what is now northern Nigeria and southwestern Chad. This agrees with what is known from historical studies (Fage 1969). It is not possible to say why the Kusasi first came to the area where they live today, but it was probably part of the general migratory movement that seems to have characterized much of west West African history, resulting from trading, slave raiding, movements of nomadic herders, and military movements by various states and kingdoms. It is difficult, too, to know the origins of the Kusasi intensive agricultural system, based on the manuring of a permanently cultivated compound field adjacent to each house. Extensive farmers in the Mole-Dagbane area also have manured compound fields but they are abandoned when fertility wanes. High population density and intensive farming appear to be correlated in northeast and northwest Ghana.

It may be that present population distribution is to some extent influenced by slave raiding. Hill areas in

northern Ghana are often more heavily populated, partly because they tend to have more fertile soil, but it could also be a result of the refuge they provide from slave raiders, as well as local hostilities.

Societies in the Mole-Dagbane area can be divided into those with chiefs organized into kingdoms, and those acephalous groups without a tradition of chiefs or kings. Both groups are, however, patrilineal societies. It is probable that small groups of warriors from the north brought the ideas of kingship and chiefship to the Mole-Dagbane area, founding the kingdoms of Dagomba, Mamprussi, and Mossi among local acephalous peoples towards the end of the 15th century (Fage 1964). These invaders brought Islam and associated traditions such as the use of the horse and wearing of a red fez, still symbols of chieftancy today. The Kusasi and other smaller groups occupy a sort of buffer zone between the states.

The kingdoms were involved in the north-south trade, and it appears that it was originally to protect trade routes that attempts were made to set up chiefs and establish some control over the acephalous societies outside of the main kingdoms. This process was still going on in northeast Ghana at the time the British first established effective presence in the area in 1900, cutting short a retaliatory raid by the Manprussi against a makeshift alliance of a

few Kusasi villages. It was not until the British established control and demanded to deal with the local population through a chieftancy system that it became firmly established in the acephalous groups.

Amongst acephalous groups like the Kusasi the largest political units were villages, with much fighting going on between, or sometimes even within them. The oldest man in each village, or part of a village, is designated the "tengindana" (lit. "land owner," but often translated as "earth priest"), who is in charge of allocating land and making sacrifices at harvest and other ceremonies. In addition to spirits of the earth and other natural objects, the Kusasi believe in ancestor spirits, and events of the agricultural cycle are marked by sacrifices and ceremonies honoring these forces in Kusasi life. Tengindanas are still important today; people say that they are in charge of the earth, while chiefs are in charge of the people, a role the tengindana never had. Even in the Mole-Dagbane kingdoms there is still a recognized division between the local and invading group, one with their tengindana and the other with their chief, with mutual interdependence emphasized on ceremonial occasions.

The most restrictive environmental consideration for Kusasi farmers is water, and food production is almost entirely dependent on rain. Some farmers are able to cultivate

dry-season gardens by watering from shallow wells dug in stream beds. During the rainy season a small quantity of rice is grown beside little streams.

Daily distribution of precipitation during the May to October rainy season is highly variable. Farmers begin planting after the first two or three good rains in late April or May, and if there is subsequently a temporary dry spell, then extensive replanting is required. This has been the case during the last several years in Kusaok. Replanting, however, can only be done for a certain period because of limitations imposed by growing periods and labor available for weeding later in the season. Poor rains in June and July of 1976 led to poor yields of early millet, while exceptionally heavy rains in October, during setting and development of seed on late millet and sorghum, led to poor yields of these varieties, with a high incidence of smut.

The extreme temporal and spatial variability of rainfall is met with the Kusasi belief that it is controlled by certain "rain owners," or gods, and appropriate sacrifices and tributes have to be made to ensure a good rainfall. On the other hand, Kusasi farmers employ methods to make the most of the water they receive such as using more drought resistant varieties in shallow upland soils and planting

less drought resistant varieties like early millet in valley areas or on manured fields. Terracing of hills and planting of grasses across shallow valleys helps to slow down run off. Yet the intensity of cultivation has led to an increasing amount of erosion, creating large expanses of soil with much reduced fertility.

Most of the streams in the area are intermittent and there is little surface water in the dry season. Water for drinking and domestic use is obtained from shallow wells, or more recently from deeper lined wells, dam ponds or tube wells. These first three water sources are subject to heavy contamination and are foci for the spread of disease

The wet season brings its own water related health problems, with mosquitoes breeding in shallow ponds and puddles and bits of pot shards. The black fly (Simulium damnosum) which is the vector for river blindness, breeds in fast flowing streams. Hence this disease is more prevalent in the granitic and metamorphic areas such as Kusaok, as opposed to the sandstone areas, since the former's steeper stream profiles lead to the higher velocities necessary for black fly breeding. River blindness is hyperendemic north of 10°30' along the major river valleys and associated streams (Hunter 1966a:265). Among the Namnam just east of the Kusasi (see Fig. 10), there is evidence that there has been at least one cycle of advance

toward the Red Volta in the late 19th century (Hunter 1966a). It was caused by a period of poor rains and insufficient production, followed by a longer period, since about 1918, of retreat from the river primarily because of onchocerciasis. It is easy to see from maps showing population distribution that much land along the large rivers is virtually uninhabited due not only to onchocerciasis but also to trypanosomiasis.

Within the northern savannahs of Ghana are three main groups of soils whose properties are determined primarily by the parent material over which they developed (Ghana Geological Survey 1955; Adu 1969).

1. Soils developed over Birrimian rocks of metamorphosized lavas and other intrusives are inherently fertile with high phosphorus content; rate of erosion is high because they are found in hilly areas; they correspond to the eutrophic brown soils of Figure 8.

2. Soils developed over intrusive granites are not as fertile, but respond well to manure and fertilizer applications; they are shallow, and under intense cultivation and grazing may develop large, severely eroded areas in which most of the organic content is gone, as around Bawku town and in the larger Pusiga area to the east of Bawku.

3. Soils developed over Voltaian rocks -- sandstones, shales, and mudstones -- give generally poor quality soils with low nutrient content, but good drainage, and yams are a common crop in these areas.

These last two soils are in the area classified as ferruginous soils in Figure 8.

There is a general association between the distribution of these soil types and population density, with highest densities on the granitic areas of northeast and northwest Ghana. This is demonstrated on a more local scale by data from a 1955-57 survey of 68 square-mile sections in the Frafra area northeast of Bolgatanga (see Fig. 10). The more fertile soils carry higher densities of both humans and livestock (Topham 1957). In Upper Volta, however, there does not appear to be a good correlation, as the heavily populated Mossi area in the center of the country has poorer soils than the sparsely populated areas to the east and west.

All soil types are affected by slope, with the upper inter-valley soils being the most fertile and easily worked, and less subject to erosion. Lower slope and valley soils tend to be heavy with high clay content, subject to water-logging and difficult to work with hoes or ox drawn plows. Kusasis have a soil classification system which they use together with their knowledge of the requirements of various crops in deciding what to plant in each field.

Fire and cultivation are the two major effects of man on soils, leading to decreased organic content and exposing the soil surface to wind and water erosion and insolation.

The granite areas which make up most of Kusaok are characterized by a gently rolling terrain of 150 - 250 m

elevation. The Birrimian greenstone hills northwest of Bawku town rise fairly steeply to an elevation of 420 m. At the southern edge of Kusaok, where the Voltaian sandstone begins, the Gambaga escarpment rises abruptly from the valley of the Morago River to 500 m. In the rainy season there are many small streams flowing, and gully and sheet erosion are common throughout the area. In the dry season only the major rivers have water, and they are reduced to not much more than a trickle.

The dominant vegetation in the sparsely settled areas of Kusaok is a relatively stable fire pro-climax community of broad-leaved deciduous trees densely distributed in a continuous ground cover of perennial bunch grasses and associated forbs. The trees have spreading crowns at 12 to 15 m, but seldom form a closed canopy (Rose Innes 1977). These relatively open conditions are the result of centuries of fires, probably often started by humans either accidently, for purposes of hunting, or to promote pasture development.

Once clearing for agriculture begins, only trees, selected because of their economic value, are left standing. In several locations in Kusaok, extended periods of cultivation and grazing have resulted in soil exhaustion, denuding, and extensive erosion.

The annual agricultural cycle is summarized in Figure 11. Field preparation begins several months before the first rains and is generally limited to the compound field and fallowed fields that are to be replanted. If the farmer has enough time to spare, weeding often begins in the latter during the preceding rainy season, while the ground is soft. On previously cultivated fields preparation takes very little time, and a few hours a day may be spent rearranging the abundant rocks into heaps, or making them into ridges to check water erosion. Remains of old stalks and leaves are raked together using a few stalks held together in one hand to form a simple broom. They are heaped in small piles and burned just before the rainy season is due to start.

The application of animal manure to the compound farm before planting is an extremely important part of the Kusasi intensive farming system. Goats, sheep, chickens, and guinea fowls are kept at night in their own rooms of the house, close to the outside door. Before the rains the manure is scraped from the floor and carried in baskets to the field where it is dumped in small heaps to be distributed by the rains. Farmers who keep their own cows and bullocks, instead of giving them to the Fulanis to herd, keep them enclosed at night so that their manure can

SUBSISTENCE ACTIVITIES and FOOD SUPPLY

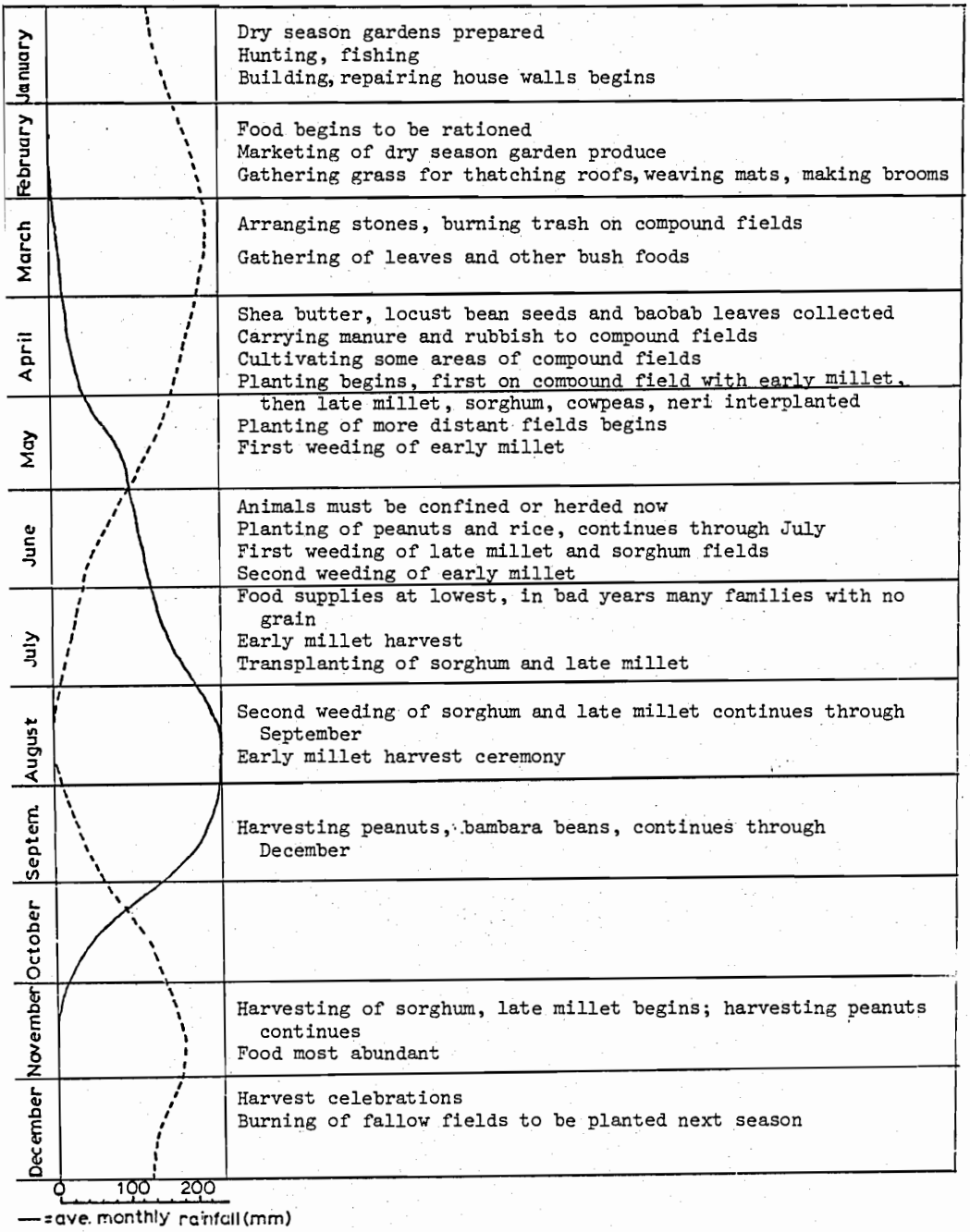


Figure 11. Agricultural Cycle in Kusaok.

also be used. The value of manure is well appreciated by the Kusasis, and they even go to Fulani houses to ask permission to gather manure from tethering areas to carry back to their own fields. The heavy manuring around Fulani houses produces noticeably better crops than the average. When the harvest is poor, farmers may sell animals to get money for food. Several years of bad harvests such as those recently experienced, may reduce a farmer's supply of manure and thus increase the difficulty of improving yields.

Sowing is done by all members of the household who are old enough, beginning with the compound field. A narrow-bladed (5 cm) short-handled (50 cm) hoe is used in one hand to make a hole, while several seeds are dropped in from a calabash with the other hand. The compound field is usually sown to early and late millet and sorghum, with cowpeas (*Vigna unguiculata*), neri (*Colocynthis citrullus*, a seed producing gourd) and okra (*Hibiscus esculentis*) often scattered about among the grain.

As sowing is completed on the compound farm, activity will be moved to more distant fields. Late millet and sorghum are the most common crops here, but peanuts and bambara groundnuts (*Voandzeia subterranea*) may be interplanted and form an important part of the crop rotation cycle.

Farmers with a field in a moist valley area may plant red rice.

The boundaries and sides of paths through fields are often planted with sesame (Sesamum indicum), beregas (Hibiscus cannabis -- leaves are eaten in soups and fiber for rope is made from stalks), and bit (Hibiscus sabdariffa -- same uses as H. cannabis). Women also plant their kitchen gardens at this time, which contain mainly okra and several varities of edible leaves.

Weeding is done with a short-handled hoe with a medium width (15 cm) blade. Weeding of the early millet in the compound field must begin before planting in the most distant fields is completed, as it is very intolerant of weed competition. It is weeded a second time before harvesting in July, when it provides a welcome respite from hunger for the farm families in the middle of the heavy work season. Crop production may suffer as a result of insufficient food to keep farmers strong and active at this time. Late millet and sorghum on the compound field will be weeded once again if there is time. More distant fields are weeded twice, except groundnuts and bambara beans which are only weeded once.

The household head must decide each day what fields will be weeded. Labor is the critical resource at this time

of the year, and must be distributed according to amount of weeds present, weed tolerance of different crops at various stages of growth, and time and difficulty of weeding various fields. Some farmers use ox drawn plows for field preparation and weeding.

In the early part of the rainy season, weeds are simply chopped out with the hoe and left on the surface to die. Later, at the heaviest part of the rainy season, when weed growth is luxuriant, weeds are heaped in piles in the fields and covered with dirt to prevent them from re-rooting. This also provides green manure for the next season.

Harvesting of late millet and sorghum occurs in November, and rice in December. Peanuts and bambara beans are harvested from September through December, as there are early and late plantings. Little crop residue is left in the field to maintain fertility, as the demand for energy is so great that almost all parts of the plant are used. Millet and sorghum stalks provide the main fuel for cooking, beer brewing, and pottery making; they are also used in mat making and to some extent in construction, and provide a source of income to women who may carry them to the market to sell. The threshed heads are used for scouring or animal feed. Peanut leaves and vines are a

major source of animal fodder in the dry season.

Water erosion is combatted by constructing crude stone terraces and retaining walls and planting certain species of grasses in run-off areas. Again, due to pressure on the land, steep hillsides and gullys may be cultivated.

As the harvesting ends, the dry season is beginning, with the harmattan wind starting to blow in out of the northeast after the first of the year. The landscape is soon changed from green to brown, and burning of grass on pasture and waste lands begins.

Various surveys in Kusaok show an average total cultivated land per person of about 0.5 ha, about one-half of which is in compound fields. The compound field is the center of the intensive farming system and is adjacent to the family homestead. This is usually the only place where early millet is grown since it needs manure and constant weeding. In addition to early millet, one or more other varieties of late maturing millets and/or sorghums are interplanted, and cowpeas and neri are grown at wide intervals. Different areas of the compound farm may have different mixtures planted on them, or even occasionally pure stands, depending on the soil and drainage characteristics. Farmers vary the mixtures from year to year according to their experiences of the previous year.

Part of the compound field closest to the homestead may be planted to a small stand of kenaf, or a mixture of kitchen vegetables. This area may be cleared late in the rainy season sometimes, and replanted to leaf tobacco.

At various distances from the compound field are usually one to three fields planted mainly to late varieties of millet and sorghum. These fields seldom, if ever, receive any manure, and were traditionally fallowed to renew fertility. Increasing pressure on land has led to a shortening of the fallow period on these fields, fertility being maintained as much as possible by rotation of crops.

Conceptually distinct from these farms where the staple grains are grown, are fields where groundnuts, bambara beans, rice, or cotton are grown. Fields may rotate between being a grain field and legume field, or may even be divided in two. Very little cotton is grown, especially in recent years. The market value of food crops compared with the government price paid for cotton, even when input subsidies are considered, makes it uneconomical. Cotton is not a traditional crop of the local people, being grown by Fulanis.

The compound field and the outlying grain fields, and perhaps some groundnut, rice, and cotton fields, are considered to be those of the household head, and all household

members old enough to work on them are expected to do so, for they will be fed during the year by the produce from these fields. Most older household members have their own fields as well, which may be given to them to cultivate by the household head, or by someone else. The produce from these fields is theirs to consume or sell as they see fit. All wives have a kitchen garden behind their room where they grow ingredients for the soups which always accompany the millet or sorghum porridges. Revenue from selling some vegetables, or groundnuts from their own fields are used to provide such items as salt and dried fish, as well as personal items like cloth, pots, and sacrificial animals.

The staple crops grown in the Kusasi area are millet and sorghum; other grains such as corn and rice may be grown in small quantities but are not important in the diet. These two cereals are well adapted to the soil and rain fall; varieties with shorter and shorter growing seasons become dominant as one moves from south to north. Other crops grown in Kusasi include peanuts, bambara beans, cowpeas, neri, and several vegetables such as tomatoes, okra, and onions. Many varieties of naturally occurring plants are also used as food sources, including the three trees already mentioned, and play an important role in the diet. Many herbaceous weeds are gathered from

the fields during the beginning of the rainy season to be used in soups. Meat plays a small, but perhaps significant, role in the diet. Animals, with the exception of pigs, are seldom, if ever killed solely for eating. Sacrifices of animals, however, are always consumed, and some such sacrifices tend to occur in stressful situations when extra high quality protein is valuable. Most common animals are chickens and guinea fowls, with sheep and goats next. Little game is caught during dry season hunting expeditions as it has mostly been removed from the high density areas by the increasing human activity.

Nutritionally the diet is of good quality, the major problem being one of quantity. The main dish is a thick porridge of millet and/or sorghum flour dipped with the hands into a soup,which is eaten in much smaller quantities. The most common soup ingredients are fermented locust bean paste; legume, sesame, and other ground up seeds, dried yeast from beer brewing; leaves, okra, and other vegetables; hot pepper; and salt. Soups are generally high in minerals, vitamins, and proteins, with the porridge containing 70 per cent of the dietary protein and 85 per cent of the calories (Gordon 1973). If adults eat enough of this diet they will be well nourished. It is often difficult, however, for children (6 months to 3 years) to eat enough, especially

when they are sick. Studies in Tenga show a typical pattern of increasing malnutrition and decreasing rate of weight gain after 5 - 6 months when breast milk is no longer adequate. The marked seasonality of the agricultural cycle, with food scarcity coming at the time of greatest demand for agricultural labor, also leads to significant weight loss in adults, as shown by studies among the Namnam (Hunter 1967b) and in Tenga.

In Kusaok grain is stored unthreshed in mud granaries built on a stone foundation and topped with thatch. An insect repelling substance is prepared from a local plant and used in the plastering of the inside of the granary. Losses in these granaries, due mainly to insects and fungal diseases, vary widely, but are surely significant. Only the male head of the household is allowed to look into and take from the granary. He distributes amounts to the wives in his house according to their estimated needs and at intervals of about a week. Women thresh the grain with wooden flails on beaten earth thr shing floors or on large boulders and grind it into flour on specially shaped stones. More recently they may have the option of taking the grain to a small diesel mill.

There is some sexual division of labor from the time that children first begin to help their elders, but this

becomes more rigid as they get older. Men do the majority of the agricultural work, with women helping mainly during sowing and during harvesting by cutting the grain heads from the stalks which the men have uprooted or cut near the ground. The heavy jobs of field preparation and weeding are reserved for men. This is not to say that the women's work of hauling water and fuel, threshing and grinding grain, and caring for children is any easier. On their own fields women may do more of the work, and they care for their kitchen gardens by themselves.

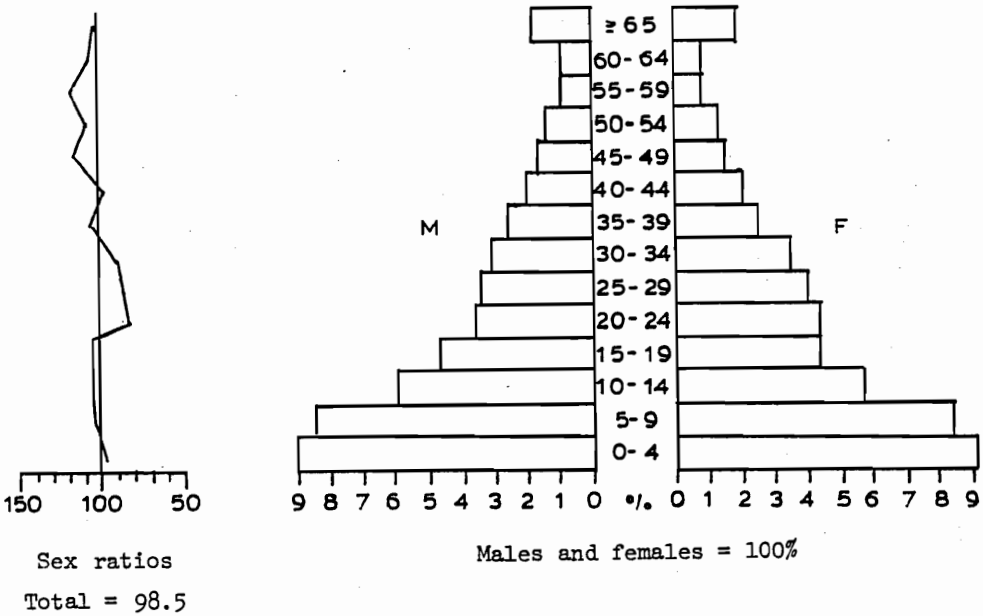
Children begin working regularly with their parents by the time they are eight to ten years old. After about age 55 the work load becomes considerably reduced, although old people continue working in the fields as long as they are capable.

Most of the work on a household's fields is done by the members, but there are several types of non-household labor that are used, the most common being invited labor, in which a household head invites several relations and/or friends to help him in weeding in return for providing food and/or beer for them. This is not a strictly reciprocal arrangement, and older people can request this kind of help without being expected to repay. A less common form is reciprocal work groups, often of younger men. More common

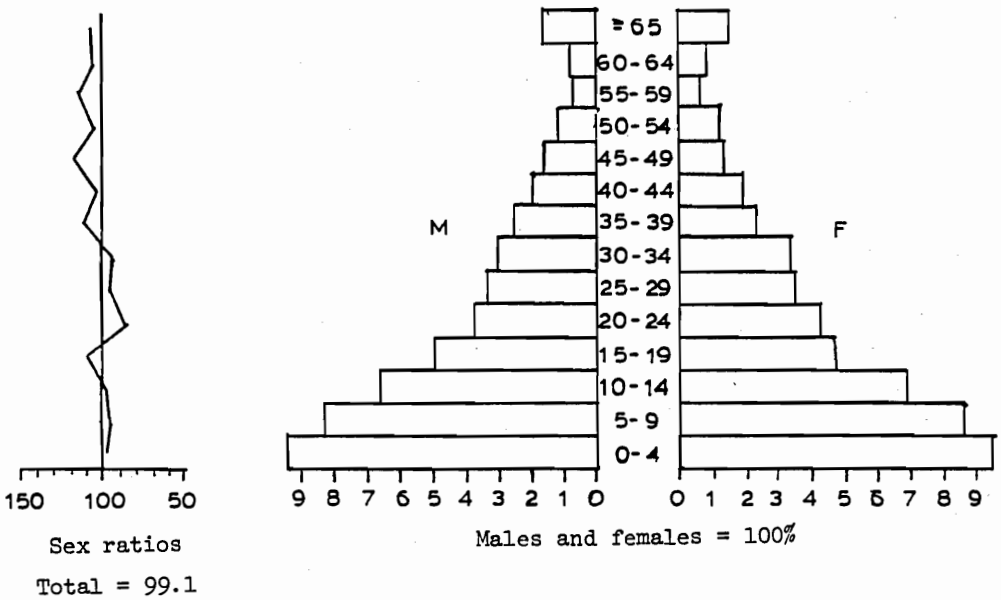
in the past than presently was the obligation of a son-in-law to work for his wife's father a reasonable amount of time after first marriage. Wage labor is rare but becoming more common.

Population structure in Kusaok and the rest of northern Ghana differs markedly from that in the rest of the country. Figures 12a-c, 13 compare the whole of Ghana, the Upper Region, and the Ashanti Region, a forest area in the south where extensive agriculture is practiced and where many migrants from the Upper Region go to work on the cocoa farms. Figure 12d-e shows the population pyramid for the Bawku District (which contains almost all of Kusaok) and for Tumu District, located in the central-western part of the Upper Region. Tumu is sparsely inhabited by Sissala and other tribes who practice an extensive bush fallow agriculture (see Figs. 10, 14).

The pyramids for the Upper Region are different from Figure 12a-c mainly in the rapid reduction after the 0 - 9 age groups, and the excess of females in the 15 - 44 age groups. The first characteristic is at least partially explained by the fact that the mortality rate in the Upper Region is the highest in Ghana (Gaisie 1976). The distorted sex ratios in the most economically active portion of the population are primarily due to emigration to the south



a. GHANA, ALL REGIONS (Total = 8,559,313)



b. ASHANTI REGION (Total = 1,481,698)

Figure 12. Population pyramids and sex ratios, Ghana, 1970 (from Ghana Census Office 1975).

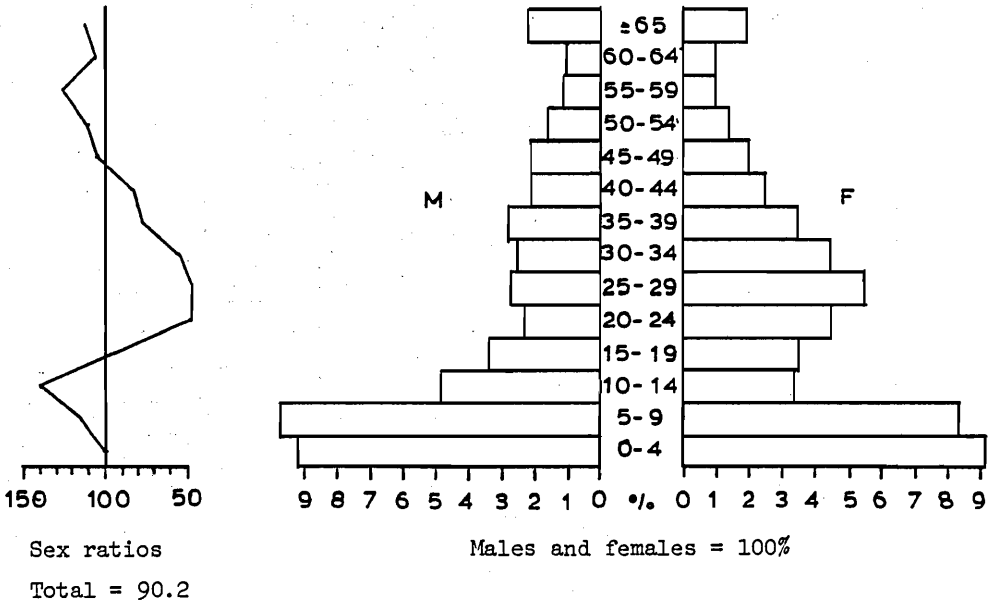


Figure 12c. UPPER REGION (Total = 862,723)

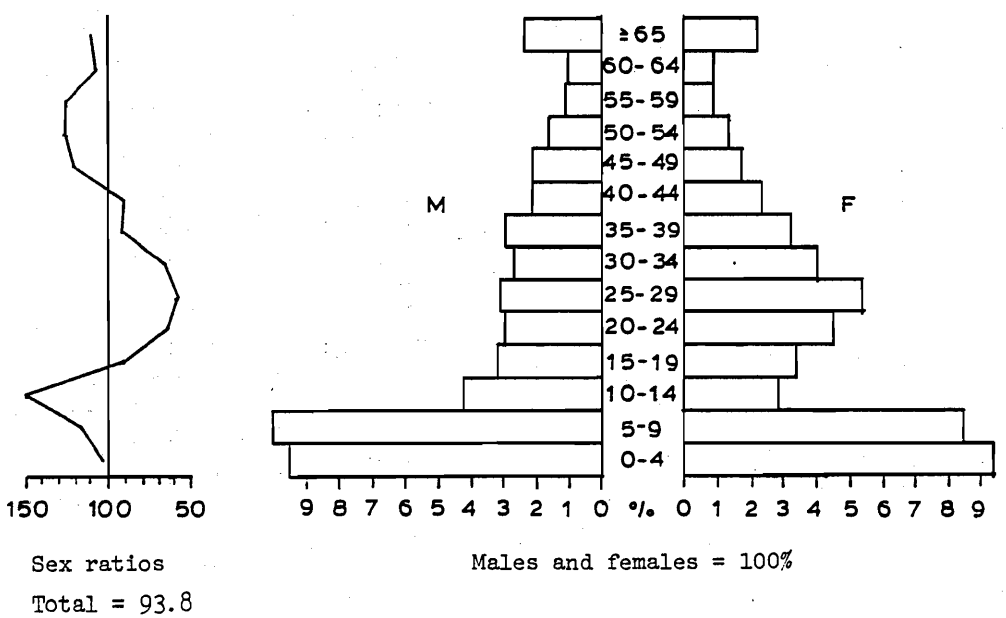


Figure 12d. BAWKU DISTRICT (Total = 221,868)

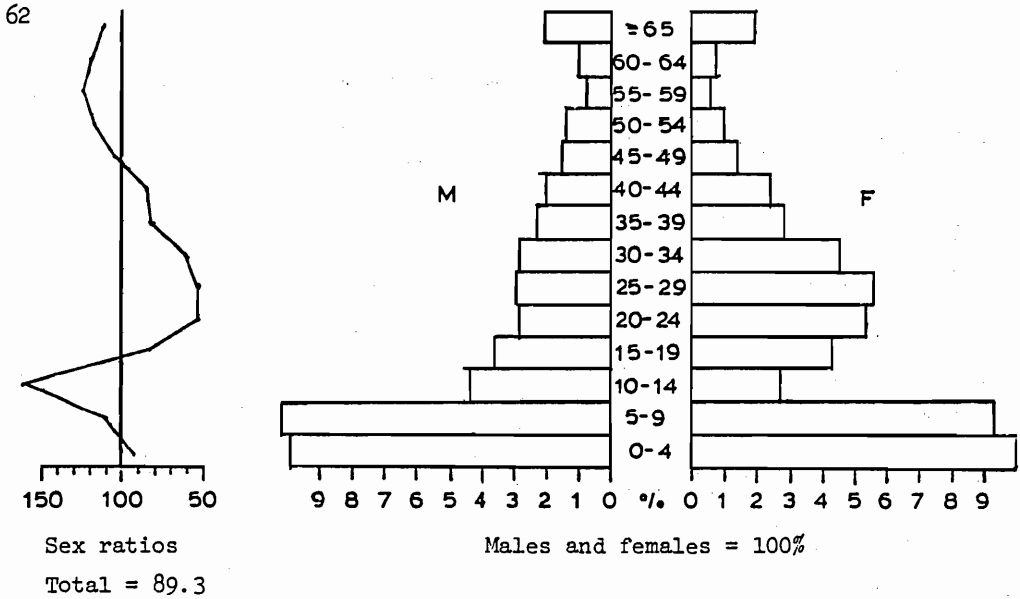
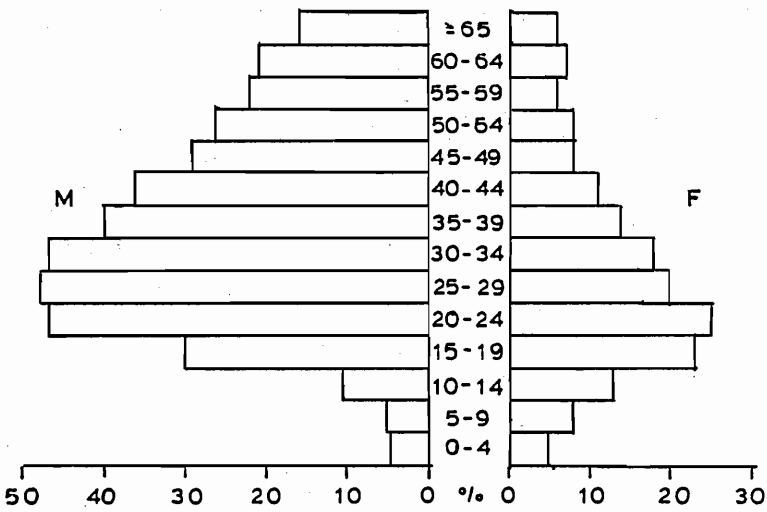
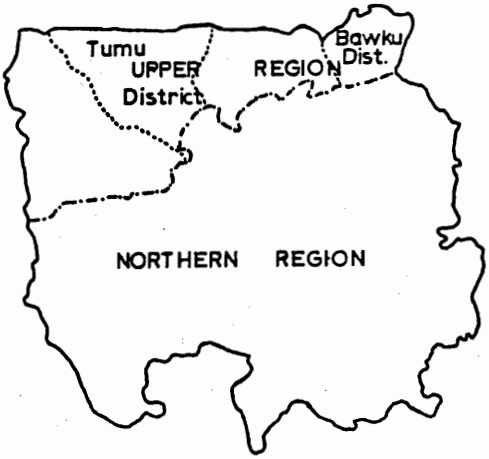


Figure 12e. TUMU DISTRICT, 1970 (Total = 42,442)



% of each age/sex group (from Ghana Census Office 1975)

Figure 13. Percentage of people born in the Upper Region not residing in the Upper Region, 1970.



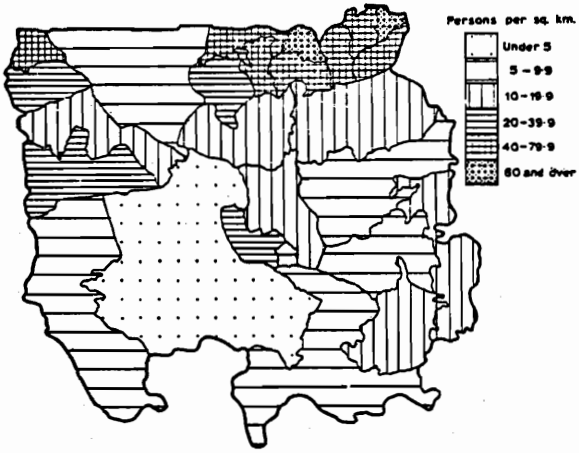


Figure 14. Population densities in Northern Ghana, 1970 (from Engmann 1975).

(cocoa farms, military/police, and service industry jobs), and reflect the relative lack of agricultural and economic opportunity in the savannah areas of the north. The age and sex structure of a population are determined by migration, mortality, and fertility.

Hunter's (1966b) calculations based on the 1960 census show that in the northern savannah areas of bush cultivation such as Tumu District, there is a definite correlation between population density and sex ratio in the 15 - 44 year age group in the various enumeration districts. Hunter sees this as indicating a response to deteriorating prospects for making a living with increasing numbers of people. In these non-granitic extensively farmed areas of the northern Ghanaian savannahs there may be little scope for intensification due to the poor quality of the soils compared with those in the northeast and northwest, so that population pressure leads to emigration rather than to intensification. In the intensive farming areas of the northwest and northeast, sex ratios are similar over a range of higher population densities. Population growth here has led to densities in excess of the system's ability to support them, and emigration is equally heavy over a range of high population densities.

Genealogical information for one major lineage in Tenga indicates the increasing incidence of migration over the last nine generations. There were a total of 136 men who had reached marriageable age, and 52 per cent of them had been migrants, most of those now dead or past middle age having eventually returned to Tenga. Periods spent outside of the village ranged from one to 30 years, and the most common reasons for emigration were to search for money for bride payment, to search for land, and to see the south. There seems to be a trend through time from pull to push factors as the major motivating force of emigration from the village. Reasons most often given for returning were simply a desire to return home, and illness or death of father or other close lineage relative, necessitating the assumption of lineage responsibilities by the migrant.

Sixty-three of the men in the lineage who have reached reproductive age were alive at the time of the survey, and 57 per cent of them were living outside of the village. Three generations (about 60 years) in the past, only 37 per cent of the men were migrants as opposed to 89 per cent now. Census data for the Upper Region for March 1970 shows a very large proportion of males outside of the Upper Region, almost 50 per cent of those 20 - 34 years old (see Fig. 13). As in the neighboring Frafra area, there is a

growing tendency for migrants to stay away longer or even permanently (Nabilla 1975; Hart 1974).

The impact of this high rate of male outmigration on agricultural production is difficult to quantify, although it seems to be harmful. In Tenga it is not uncommon for old parents to be farming alone or with only young children while their adult sons are in the south working and sending little, if any, of their income home.

Infectious diseases are important factors affecting the potential for agricultural intensification. Their effect on population distribution is well documented, but the effect on working efficiency and motivation is less well known.

One of the most dramatic and important infectious diseases in the Kusasi area and in much of the West African savannah is onchocerciasis. The filarial worms in the body often migrate to the eyes causing blindness, which typically means the removal of the affected person from the work force and his conversion to dependent status. While blindness is the most dramatic symptom, other effects of infestation are also debilitating. One survey in northeast Ghana in 1966 of 16 villages found 3.7 per cent of the population blind, with the rate of infection with the parasite in persons 15 years and older well over 50 per cent (Senker et al 1973).

Together with the other infectious diseases mentioned, onchocerciasis contributes to the relatively high mortality rates in the Upper Region, which are the highest in the Ghanaian rural population at all age levels. Of every ten children born, only about seven survive to the age of five, and only five survive to the age of 35. Life expectancies reflect mortality rates and are also lowest in the country (Gaisie 1976, Chapter 4).

Another effect on agricultural production which must be mentioned is the expenditure of time and resources on illness. In Tenga the prevalence of children's diseases (during the two weeks before interview, as reported by mothers) rises from about 15 per cent in April, to about 40 per cent in July. The higher rates occur in the rainy season when demands of agricultural work are the highest. The most common childhood illness was diarrhea (42%), a typical finding in tropical subsistence communities characterized by a high rate of malnutrition.

Treatment of disease follows from the dominant belief that it is primarily due to social factors. Spirits of ancestors, witches, or living people are presumed to be the primary cause for an illness. Much time and resources are spent in sacrificing and consulting with experts in attempting to determine the agent responsible and then in

placating or defeating it. Symptomatic treatment, however, is sought both from traditional sources and western medicine, the latter being favored for young children.

Although people in Tenga say that they remember a past when people lived longer and were sick less often, it seems that mortality has actually been declining. Estimates based on data gathered in 1948, 1960, and 1968 indicate a slow mortality decline during WW II and the early 1950s, and a rapid decline thereafter, with life expectancy in the rural population of the Upper Region estimated at 38 in 1968, still the lowest in Ghana (Gaisie 1976:137-39). Data on infant and child (0 - 4 years old) mortality from Tenga support this, showing a drop from about 300/1000 in the 1940s to about 150/1000 in the 1970s, a trend that is probably partially masked due to the greater forgetfulness of such children by the older women interviewed.

In the face of declining agricultural productivity and increasing population, a trend to declining mortality may seem puzzling, when one might expect, from a Malthusian perspective, just the opposite. Public health measures and provision of medical care are generally thought (Gaisie 1976) to have had an important influence: providing wells, vaccination campaigns, distribution of antimalarials, setting

up of mission and government health posts and hospitals, and campaigns against such vectors as tsetse and black fly have all been important in the Kusasi area and northern Ghana. Another important consideration is that western influence has led to a greatly expanded trade and migratory network, so that local populations are no longer so narrowly dependent on their own resource base, and population reduction is limited. This process is based on the building of roads that allow for transport of food from food surplus to food deficit areas, the movement of people out of food deficit areas, and the movement of cash into the area through migrant and local labor. The result is an increased rate of population growth due to declining mortality rates and possibly increasing fertility rates.

While fertility rates in the Upper Region are the lowest in Ghana (Gaisie 1976), desired family size is the largest (Caldwell 1967; Gaisie and David 1974). This has important implications for the control of population growth in the overpopulated subsistence agricultural areas of the savannah that will be more fully considered in the next section.

Preliminary analysis of fertility data from Tenga indicate a trend to increasing fertility since 1918, especially in younger age groups. The most important reason for this

may be the decreasing birth intervals reported by informants, decreasing from about four to three years in the last two to three generations. Birth intervals are consciously controlled by a post-partum taboo on sexual intercourse for the mother. The decision to terminate the taboo is taken on the basis of the youngest child's health, and the most frequently given explanation for exceptionally long birth intervals is that the older sib was sickly, and that the parents had to wait until he was healthy. The effects of too short birth intervals are appreciated by the Kusasis, who say that they can recognize the unfortunate older sib by his lean, sick condition. The increasing availability of Western curative medicine has tended to increase parental confidence that a child's illness can be successfully treated, while public health measures have probably led to a decrease in infant and (to a greater degree) child morbidity rates.

Increased personal security resulting from the establishment of the Pax Britannica around 1900 may also have contributed to reduced birth intervals. In the past mothers had to worry more about small children when gathering wood or food in the bush, visiting in another village, or going to market. If they were molested they would only be able to carry one child. Another contributing cause of higher

fertility may be the decreasing age at marriage, the result of increased sexual awareness and greater social and economic independence on the part of young people of both sexes. In Kusaok a man must give four cows for a wife, and with increasing economic hardship these may become more difficult and expensive to obtain. It is uncertain whether this affects age at marriage, since young couples often run away to the south, and arrangements can be made to delay payments of the cows.

There is a developmental cycle in Kusaok in which households may move through several stages beginning with just a man, his wives, and children. From this simple nuclear family develop extended families of a man and his married sons, and then, when the father dies, to a senior brother and his own brothers, some of whom may have married sons of their own. A final stage of nuclear families may be reached when an old man or woman, or man and wives, live alone with no resident children. By far the largest proportion of households in Tenga are of the nuclear type.

To the casual observer in Kusaok the average household may appear to be very large because people from nearby households gather when a stranger is visiting. In fact, in Tenga, the average size of household was 7 (median = 5.6) with a range of 1 - 33. These values are similar to those

obtained in other studies in northeast and northwest Ghana and in northern Nigeria. Average household size for the Upper Region in the 1970 census was 6.6, about the same as the northern region, but larger than that for the rest of the regions of Ghana.

The extended families in Tenga have more people in them, and a proportionately larger number of young, non-producing children (less than 9 years), but there appears to be a limit to the proportion of these young children at about 0.4, the median value for all household types being 0.3.

The most important productive resource by far is the compound field adjacent to the house which receives most of the manure. While sons of a deceased father may farm together for a while, disputes often develop rather quickly over relative amounts of labor contributed and amounts of produce consumed by the individual nuclear families. This leads to a division of the farm lands, the compound field being divided in wedges that all abut the house. Related family heads may continue to live together in the same house, although separate entrances may be used for the different households, and separate granaries will certainly be established. With increasing scarcity of land, and smaller and smaller parcels of the compound field, there is a tendency for increasing emigration.

While there is less agreement on the degree to which household size and type of agriculture practiced correlate than on the relationship between the latter and population density, there does seem to be a tendency within the Mole-Dagbane area for smaller household size to be related to increasing agricultural intensity. Among the Yatenga Mossi, even though settlement tends to be nucleated, "the elementary family as a unit in the productive system functions nearly autonomously" (Hammond 1966:96), and increasing land scarcity has resulted in a decrease in the number of people per dwelling from about 25 - 40 at the beginning of this century to about 9 - 10 today (Marchal 1977).

Other factors may be important, however. In the northwest of Ghana, Goody (1958) found that household size was smaller for the LoDagaba (7.0, with 1.5 men) than for the LoWiili (11.0, with 2.5 men) even though LoDagaba practice more extensive agriculture and have a lower population density (1.5 acres per person vs. 0.9). He sees the reason for this being the importance of matrilineal inheritance with the LoDagaba which leads to early fission of domestic groups, since a man's sons know that when their father dies a member of his matriclan and not

themselves will inherit food they helped their father to produce, and the livestock that might otherwise help to get them brides. With greater land availability in the LoDagaba area, there is a greater tendency for sons to migrate in order to build up an economic independence.

An important factor in Tenga that may keep households from breaking up and growing small with increasing land scarcity and intensification of agriculture is wage laboring by one of the adult male members, while one or more other adult males remains a full-time farmer. Resources are shared, the cash allowing for the purchase of oxen, plows, and fertilizers that can increase production per unit area and even for the acquisition of more non-compound fields by borrowing. At times of crop failure, the cash may be used to purchase food in the market. Surveys in Tenga showed that 15 per cent of all households consist of non-growing nuclear families, in most cases with a male head and no adult children, but in some cases with a female head. The average number of members was 2.0. These households are usually the result of migration or death of sons or brothers and are among the poorest in the village.

Since migrants seldom return any resources to their homes, much less enough to make up for the loss of their

productive labor, emigration would seem to represent a negative influence on the possibility for increased production. In fact the knowledge that older sons may often slip away to the south may act as a spur to increase fertility to replace labor lost to emigration. Observations in Tenga indicate that children begin to be net producers around the age of 10 years. This is supported by survey data (Caldwell 1967:226-27), showing that 49 per cent of respondents in rural areas of the upper and northern Regions thought that children earned their keep by age 5 - 9, and 74 per cent thought that this happened by the age of 10 - 14; and to the question "What are the good things about having lots of children," 55 per cent said that "they work on farms and in households." These are much larger proportions than for the rest of Ghana.

Thus decreased infant and child mortality may not lead to decreased fertility in these impoverished savannah subsistence farming areas, but to just the opposite. The fact that more children survive makes the total resource cost of each child (productive unit by age 10) less in terms of additional maternal resources necessary for pregnancy and lactation, and lost maternal and other household member productive energy spent in child care, especially during illnesses.

Population growth in Bawku District has resulted not only from natural increase, but from southward migration from what is now Upper Volta. This migration was especially heavy in the first part of this century, before the 1931 census, and was greatly influenced by French administrative policy. After this period natural increase was the most important factor, and has led to an increasing rate of growth. Between 1949 and 1960 the average annual rate of increase was 0.48 per cent, but between 1960 and 1970 it was 2.35 per cent, to give a 1970 population of 220,000.

Population densities have also increased dramatically from 49/km^2 (127 mi.^{2}) in 1931 to 71.4/km^2 (184 mi.^{2}) in 1970. Population is, of course, not evenly distributed, and large areas of Bawku District are uninhabitable due to onchocerciasis and trypanosomiasis, so that 1970 densities in cultivated areas was 94/km^2 (372 mi.^{2}) and 272/km^2 (704 mi.^{2}) considering cropped land only.

It is generally agreed that population density is directly related to agricultural intensity in northern Ghana. In the northeast and the northwest where the highest population densities are found, are the intensive systems based on manuring of permanently cultivated compound fields (see Fig. 14). When population density for people who are

normally intensive cultivators is decreased, then extensive methods are taken up. Goody noted this for the northwest (1958:64), and settlers to government resettlement schemes from densely populated Frafra district to sparsely settled areas of the Northern Region did the same thing.

While other factors may influence the degree of agricultural intensification, their most important effects may be through their influence on population densities.

There doesn't appear to be so direct a relationship between settlement pattern and agricultural intensity, and there exists little hard evidence for northern Ghana. In the Upper Region, settlement is dispersed throughout, in areas of both intensive and extensive agriculture. In the northwest there appears to be an equal degree of dispersal in less densely populated LoDagaba area where bush fallowing is practiced and for the LoWiili, where compound fields are the mainstay in an intensive system (Goody 1958).

Among the Namnam, Hunter (1967a) suggests that dispersal was encouraged by the segmentary lineage system, with no central political authority, and was made possible after peaceful conditions were established through political control of a small invading clan possibly in the late

18th century. Dickson (1971), on the other hand, believes that settlement in the northern savannahs was dispersed because of the segmentary lineage system prior to such an invasion, which had the opposite effect of tending to nucleate settlement, at least in the kingdoms like Mamprussi.

Markets have always been an important part of the local economy in the Kusasi area, and one of the major historic trade routes crosses the area, connecting the desert with the coastal forests, moving such items as slaves, gold, salt, kola, horses, and cloth. Since the advent of the Europeans, however, local economics have become rapidly tied in with the rest of the world.

Markets in northeast Ghana operate on a three-day cycle. The development of all weather roads has been slow and a paved road does not yet extend all the way to Bawku from the regional capital at Bolgatanga. There are no paved roads in the northwest. A railroad, first promised by colonial officials in the early part of the century, has never materialized and all transport is by truck over roads whose poor quality significantly increases the cost of transport.

Since Kusaok is on the border with both Upper Volta and Toto there is a flourishing blackmarket which works to the

extreme disadvantage of the local subsistence farmer. Many manufactured items from the south meant for local consumption pass across the border, pulled by a ten-to-one or greater black market rate. To some extent this is also true of agricultural goods, including food shipped in for famine relief, although this is much more prevalent in other sections of the Upper Region.

With the main harvest around November, prices in the market drop to the lowest yearly level, a 45 kg (180 lb) bag of millet or sorghum selling for about $50 in 1977. Soon after this the prices begin to soar, as petty traders and big time speculators greedily buy up the grain. Prices continue to rise throughout the dry season, and if the early millet harvest is bad, as it was in 1977, prices just before the main harvest reach levels 400 - 500 per cent of the lowest level. Other commodities also reflect this seasonal fluctuation, generally to a lesser degree.

Thus, just at the time of the year when food is in shortest supply, and demand for agricultural labor is the greatest, prices for staple foods in the markets are the highest. The situation is exacerbated by the fact that prices for livestock are the lowest at this time of the year. Farmers traditionally use their stock as a kind of bank, a hedge against food shortage, selling them when necessary to convert into grain.

During the dry season there is little agricultural activity for those not lucky enough to have a dry season garden, and time devoted to crafts and other non-agricultural activities increases, in part to supply the demand created by funeral celebrations. Most lucrative of occupations is beer brewing, always done by women, who usually use the residue to raise pigs. This job requires not only skill at organizing and directing the brewing of the beer, but financial and social skills in maintaining a popular beer house. This is a relatively new occupation, since beer brewing was traditionally done only for special occasions and was never sold. Other occupations include making and selling pots, mats, and baskets; trading; gathering or collecting items for sale; playing music; giving medical advice; and circumcising.

Within Tenga the incidence of wage labor is much higher in that area closest to the market and administrative center of Bawku, and as mentioned above, may constitute an important strategy on the part of extended families for maximizing food supply.

In Kusaok the husband provides the staple foods for the family, while the wife provides soup ingredients from her kitchen garden and purchases in the market, financed

from selling produce from her own fields, from trading, or from craft work. Thus, the budgets of each wife and each husband are separate, and there may be borrowing between husbands and wives, between brothers, or between father and son. If a household has more than one adult male, they will pool some resources to purchase such items as tin roofs, fertilizer, livestock, or a plow.

The most frequently purchased non-food items are soap, cloth, kola nuts, and local beer. Funeral ceremonies, cows for bride price, and animals for sacrifices, are the other major expenses, and funerals may be postponed for many years until the family has enough resources to buy the food and beer necessary for a proper ceremony. Out of a yearly average household income of $100 - 200 there is little left for purchasing capital inputs like fertilizer or plows.

Many of the expenses are often considered by development programs to be wasteful. For the most part, this is not true. Funerals frequently occur in the early part of the dry season and the relatively large amounts of food eaten help to restore weight lost during the hungry season. Livestock used for sacrifices is eaten and portions always shared with a wide range of relations. One of the four bride cows is also sacrificed, and the others are often re-circulated and used for plowing (bullocks). The unstrained

local beer is nutritious, and the by products are used: the dried yeast as a soup ingredient and the mash for feeding livestock.

The British colonialists soon came to think of the northern savannahs as a cheap source of hard working labor as well as a potential supplier of food to fuel development in the south.

Recruitment for the private mines of the south began very early (1906), and was often actually forced labor under very poor conditions with high mortality rates (Thomas 1973). The government, too, recruited for construction projects, and later for the military and police, and the northerners quickly gained a reputation for hard work. Thus became established a kind of seasonal or short term migration, often of parts of the family, especially the adult males, not to establish new farms but to take part in the cash economy while retaining their interest in the home farming area. This was stimulated by head taxes, introduced in the northeast in the 1930s. To the north, in Upper Volta, government pressure on farmers to migrate to Office du Niger projects, and to cultivate cash crops and work on local government projects like road building, was apparently much more severe, and stimulated large waves of migration, at first predominantly into Ghana (Courel and Pool 1975).

While northern labor contributed significantly to the wealth of the south, the colonial government did little to improve conditions there. They hindered missionary efforts at establishing schools and missions, hoping to retain a more docile labor force and avoid conflict with Moslems. Indigenous land tenure traditions were ignored and all land was declared vested in the state (a different situation than in the south), and farmers were simply chased off land the government needed for various projects (Der 1975, Bening 1975).

There were many early attempts to introduce commercial cattle raising, cotton, groundnut, and fiber production in the north, all of which failed. Efforts continued to extract agricultural produce from the northern savannahs, and there is still a feeling on the part of some that it could become the bread basket of Ghana.

There was a growing awareness, however, especially by some of the local colonial officials, that the potential of the north to produce food surpluses was not perhaps as great as it had at first seemed. In fact, total production, especially in the intensive areas of the northeast and northwest, often fell short of need, resulting in food shortages and even famines. These food shortages were seen to be the result of three major and interrelated

factors that the colonial officials attempted to change in various ways: dense populations, land degradation, and inadequate agricultural practices. An agricultural survey of the northeast was begun in 1932 which led to an excellent report documenting the problem at that time, and also summarizing the results of agricultural experiments in the area which had begun with the opening of several agricultural stations in the 1930s (Lynn 1937). Most subsequent work on improving production of the local system was carried out in the northeast, especially in Bawku District.

Experimental work in the early 1930s confirmed the efficacy of indigenous practices, namely mixed cropping, crop rotation, and use of animal and other organic manure. Manure application of two to four tons per acre at least every four years was found to be desirable and have high residual effects. Manured fields had yields of up to 80 per cent higher than un-manured, and on the average increased total yield of grains from mixed stands by about 50 per cent (Lynn 1937, 1940). It has also been concluded that several innovations would be introduced, the most important being mixed farming. This entailed primarily the introduction of bullock plowing and the making of kraal manure. The other major innovations which were to be demonstrated were dry season gardening with shallow wells, and the use

of single superphosphate on peanuts. Peanuts were promoted as a highly nutritious food crop and a source of cash income to finance purchase of plows and bullocks. All of these innovations built on existing resources and practices: confining of small livestock at night and manuring of compound fields; the use of local trypanosomiasis-resistant West African shorthorn cattle; gardening; and growing of peanuts (an introduced crop, but one with requirements very similar to the indigenous bambara groundnut).

The main effort was put into the dissemination of mixed farming, and the results are impressive. The number of mixed farmers in Bawku District went from one in 1938, 60 in 1946, 300 in 1950, to 2,645 in 1960, distributed throughout the District. The great increase in adoption rate after WW II is associated with the establishment of the Kusasi Agricultural Development Cooperative Society (KADCS) in 1951. The 1960 figure represents about 15 per cent of farm families in the District, and 63 per cent of all mixed farms in the entire Northern and Upper Regions (Collins 1960, Uchendu and Anthony 1969).

Because the introduction of the plow in a system of mixed farming was so successful and has not since been duplicated, the methods will be considered briefly (based on Collins 1960, and conversations with Issaka Diddliman,

Chief Magistrate in Bawku and a former Agricultural Instructor in the program). Chiefs and others were brought to agricultural stations where the use of the plow and the manufacture of kraal manure was demonstrated. At Manga, a station near Bawku, land abandoned by farmers because of low productivity and erosion was brought back into production using mixed farming techniques. Trained agricultural instructors assisted by "illiterate itinerant plowmen, natives of the area...who know farmers personally" carried out extension work (Collins 1960:65-66).

To become a plow farmer a man first had to go through a period of probation as a prospective farmer for at least one rainy season. He was instructed to build a simple kraal and make manure with his stock using bedding. During this time he was visited weekly by an itinerant plowman and monthly by an agricultural instructor and his progress noted under four headings: (1) size of stock of bedding material, (2) condition of kraal, (3) amount of bedding in kraal, and (4) whether animals were kept in the kraal the previous night. At the beginning of the dry season the best prospective farmers were approved to become plow farmers (and in later years to join the KADCS). He was then eligible for a loan to purchase bullocks and plow. Bullocks were trained initially on chiefs' farms, and later on the

farmers' own farms with the help of itinerant plowmen. Graded contours were laid out in the farmers' fields, and manure manufactured during the probation period was applied. At the end of the first season as a plow farmer, a man had to make the first repayment, often in the form of peanuts and to a lesser extent, rice. The success of the program is indicated by the good rate of repayment and the increase in peanuts (1,437 to 4,422 180 lb. bags) and rice (40 to 1,354 180 lb. bags) sold by KADCS between 1955 and 1959 (Uchendu and Anthony 1969:26).

Plow farmers continue to be inspected, and only if they maintain satisfactory manure production and make payments on their loan are they provided with spare parts, namely plow shares, several of which are worn out each season. Indeed, farmers tend to think that the plow is more important than manure making. The technical staff thought just the opposite: "It really would not matter a scrap if we never extended the use of a single plough if only the manufacture of farmyard manure could become universal...which is the real solution to the food problem" (Lynn 1940:27). The goal was to prevent land degradation and increase soil organic matter, to intensify land use and labor, and technological input. It was not intended to

encourage extensive plow cultivation of farms so large that they could not be manured adequately, causing even more land degradation.

In some areas, at least, it was recent immigrants rather than Kusasis who first took up the plow (Benneh 1972) or dry season gardening (Collins 1960), but Kusasis were quick to follow, at any rate.

After independence, government support was withdrawn from the KADCS (see following section) and while current government policy in the northeast still emphasizes mixed farming, there is little actual support for it. The credit and repayment in produce program no longer functions, there is no further recruitment or inspection of plow farmers, and spare parts are expensive and difficult to obtain. In Tenga several plows had not been used in many years because of lack of spare parts and inadequate resources for buying oxen.

The North Mamprussi Forestry Conference in 1947 marked the beginning of organized land planning and conservation in the northern savannahs and in the following years, more forest reserves were established and many miles of contour bunds and numerous other water conservation measures were constructed in designated land planning areas of the northeast. It is debatable whether the net effect of these

conservation measures has been to increase per capita food production. Forest reserves removed good farmland from production, and they have not been utilized by local farmers for fuel and building material as had been originally intended. Many of the dams, while they may have led to an increase in ground water supplies and a decrease in erosion, have probably also led to an increase in such water-borne diseases as malaria, filariasis, and schistosomiasis. Many of the dams are now in disrepair and most of those that are not, are not being used to grow food. The reasons appear to involve problems with land tenure and technical problems of irrigation during the dry season.

From a social standpoint, perhaps the most ambitious approach was the attempt to reduce pressure on the land by moving large numbers of people from the most densely populated areas, primarily Frafra, to less densely populated areas of the northern savannahs. The first such effort began in 1938, when the repopulating of a valley in the northwest recently cleared of trypanosomiasis was encouraged and assisted by the government.

Between 1947 and 1957 the Gonja Development Company (GDC), a subsidiary of the government Agricultural Development Corporation, had a license to develop 30,000 acres near Damongo (see Fig. 10). It was to experiment with

mechanized farming (of groundnuts, mainly), increase food production, and resettle Frafras from the most densely populated and famine-prone area of the northeast (Dadson 1973). Initially the project was to resettle 400 to 500 families of 5 to 9 persons on areas of 30 acres each. The GDC was to provide housing, piped water, schools and hospital, and to carry out all agricultural work except weeding, which the settlers were to do. Harvest was to be shared between the GDC and farm families on a 2:1 ratio (Dadson 1973).

Farm families were almost completely dependent on the Company, with little involvement in decision making. Many settlers returned to the Frafra area and arrangements were subsequently revised to allow for greater farmer initiative in decisions about his own farm. But increasing "social," as well as economic, managerial, and technical problems led to the end of the GDC project in 1957, with insignificant numbers of Frafras remaining in Damongo (Dadson 1973:194).

A new attempt was made at resettlement of Frafras into the Damongo area by the Department of Agriculture beginning in 1956. Some lessons were learned from the previous failures and a "very careful psychological approach was adopted" (Ghana Farmer 1958), and much

initial propaganda work was done. Size of allotment for each family was reduced to 12 acres (4.8 ha, closer to the usual size in the northeast); proper customary ceremonies were carried out giving rights to land; regimentation was reduced; farm families built their own houses and fields as they wished, following soil conservation rules; and whole households were moved, so that their land in the Frafra homeland would be available (Ghana Farmer 1958; Hilton 1959).

Yet even though the Gonja people living in the area encouraged the settlement of Frafras, there was plenty of "reasonably fertile" land, and the government provided free transport, seed, clearing and plowing, it failed to attract significant numbers of migrants. The situation of over-population and inadequate food production in Frafra and the rest of northeast Ghana was not affected, and is worse today.

Attempts at improving the situation in the overpopulated intensive areas work against encouraging emigration to resettlement schemes. But social factors and attachment to the ancestral land are usually cited as the main reasons for lack of significant migration. While these social factors are no doubt significant, there seems to have been little actual analysis of the resettlement projects in terms

of actual risks and benefits to the farmers. However, because the resettlement was tied in with mechanized farming, cash cropping (peanuts and tobacco), and provision of many services to settlers, an important cause of failure was lack of adequate administrative and technical resources. The same factor contributed to the failure of national programs.

To some extent the new independent government renewed the idea of the potential of the northern savannahs to supply food to the south and for export, while making attempts to compensate for the neglect of social development, primarily by a vigorous school building program (Bening 1975). Increased education along with improvement of roads encouraged emigration of young men, helping to defeat the government's plans for the north to provide cheap food for the industrializing south. These plans have involved primarily large scale mechanized agriculture as opposed to small scale, family agriculture.

In 1962 the Nkrumah regime transferred government support from the successful KADC mixed farming program in the northeast to large scale mechanized farming ventures in the center of the Upper Region. This was the approach tried throughout the country and one which has been judged to have been a failure. The most important reasons for failure were conflicting government objectives; poor

planning and lack of background research; lack of skilled administrators and technicians; and an undeveloped and inappropriate government administration. Available evidence indicates that productivity was "much lower than in the unassisted traditional sector, and that overall efficiency was low" (Dadson 1973:197). The large scale mechanized public farms were phased out after the government changed in 1966.

By the second half of the 1960s, the pressure of the government to invest in import substitution agriculture became very great. Government efforts to increase food production having been largely counterproductive, a substantial investment was made in commercial mechanized rice production in the Northern Region. Similar projects established later at Gbidembilise valley and the Tono irrigation scheme in the Upper Region have had similar results: a dualistic capitalist agrarian structure in which the bulk of the agricultural investment is in a small number of capitalist farmers, often with government connections and depending heavily on government subsidies and special favors to reap large harvests (Shepherd 1978:3, 6, 9). The extensive techniques used by the large scale rice farmers have been destructive. Little investment such as water control or contour plowing is made in the

land, and "poorly tended and increasingly weedy and infertile fields of up to several hundred acres" are abandoned after four or five years and the process is begun again in new valleys (Shepherd 1978:10a). Recent poor rainfall has exacerbated the situation.

In 1974-75 Ghana declared self-sufficiency in rice, but output fell one-third to one-half in 1975-76 (Shepherd 1978:7) and has not improved substantially since. Even the temporary success of these schemes was only made possible by substantial state subsidies, mostly to influential northern town dwellers and more recently to southerners (Shepherd 1978:7, 12). In addition it has depended on cheap local labor and acquisition of local lands from chiefs. This has begun to create a situation that could encourage a landless peasant class, dependent on wage labor on large farms for subsistence.

The Upper Region Agricultural Development Project (URADEP), initiated in 1977 by the World Bank, the British Government, and the Government of Ghana, ostensibly aims at increasing the well being of the subsistence farmer. The aim of the project is also, however, to make the project pay for itself in the fairly short term (25 years) by including large investments in cash crops, namely cotton, and livestock ranching. It thus ignores the fact that in the

populous northeast there has long been a lack of food and increasing reduction in production potential due to land degradation, and that harvests have been particularly bad in recent years. That initially farmers in such areas require subsidization has been recognized by field workers since Lynn, who wrote: "an adequate and reliable food supply is a prerequisite of all development" (Lynn 1937:34). There is almost no consideration of social, cultural, biological, or ecological obstacles or repercussions. For example, artificial fertilizers are a major part of the program to increase both subsistence and commercial production. Yet no consideration is given to the uncertain price and availability of future supplies, or to the necessity of assuring adequate supplies of organic manure to insure that soil structure does not deteriorate. Neither is there adequate consideration of how the tremendous infrastructure needed to implement the 55 million-dollar project can be assembled and put into operation. Failure to provide adequate infrastructure, including administration, caused the failure of previous large scale programs in Ghana.

The Onchocerciasis Control Program (OCP) in the Volta River Basin area is another large scale multimillion-dollar project which includes northeast Ghana. Like URADEP, its approach is simplistic and generally ignorant of local

social and ecological conditions. For example, it assumes that onchocerciasis was the primary impediment to re-populating largely abandoned major river valleys, failing to consider other diseases, poor health of previous inhabitants, and necessity of reserving large areas for conservation purposes (OCP 1977:50-51).

Neither project takes into consideration the initial impact that the hoped for improvement in standard of living is likely to have in increasing already high population growth rates.

We have considered some of the major efforts in Kusaok and the northern Ghanaian savannahs to intensify agricultural production. It is our impression that it is the small scale programs, based on local practices and aiming first at ensuring adequate food supply that have the most chance of succeeding. Large scale projects tend to overlook the severe limitations of organizational capabilities, infrastructure, and financing, and the potential of using indigenous agricultural practices.

Given the absolute lack of adequate food supplies, and the environmental degradation in Kusaok and much of the rest of the Upper Region, it may be necessary to subsidize development programs heavily, at least at first, until adequate food supply is established and environmental degradation is checked.

Within the Mole-Dagbane area are a great number of different groups who share a very similar culture and social organization, and yet only a few have become intensive farmers. On the other hand, the hierarchical patrilineage organization seems to encourage individualization of farm organization characteristic of intensification, even in the extensive farming areas.

The intensive groups are acephalous, unlike much of the population living in extensive areas. It is true that the acephalous groups, with their segmentary lineages and lack of central political authority, encouraged a dispersed settlement pattern conducive to increased intensification of compound fields. It must be remembered, however, that it is probable that the centralized states, too, were once acephalous societies and that there is no evidence of abandonment of intensive systems. Rather, the indication is that intensity is increasing, even under indigenous, colonial, and national efforts at centralizing local political organization.

In Kusaok environmental limitations, especially water, are severe. Highly variable precipitation is confined to a single rainy season and surface water is scarce in the dry season. Soils are thin, lacking in nitrogen and organic matter, and highly susceptible to erosion. Land degradation

is intimately related to the decrease in number of individual plants and plant species. To cope with the uncertainty and fragility of his environment, the Kusasi farmer employs a number of risk-spreading strategies such as mixed cropping, dispersed field system, crop rotation, use of a number of varieties of staple grain crops, migration, and local non-agricultural work options.

Farmers have also modified the environment to increase agricultural production by manuring of compound fields, terracing, and grass planting to control water, plus burning to increase fertility and promote pasture development.

It is highly significant that in Kusaok and the other intensive areas of northeast and northwest Ghana there are better soils, due to the nature of the underlying rock, than in surrounding areas, and it may be because of this that such intensive techniques described in this section have been able to support the high population densities. It appears, however, that the point has been reached in Kusaok where efforts to support this increased population density with the present technology of intensification are <u>decreasing</u> environmental potential because of deterioration of soils and associated plant communities.

The Kusasi use a hoe, a knife, and fire as the basic tools in their intensive agriculture, the same as those

used by extensive farmers in the Mole-Dagbane area. They have knowledge of a wide variety of domestic plant species which they use to increase production by diversifying planting times, locations, and cultivation techniques.

The bullock plow, artificial fertilizers, and new crop varieties are the major technological innovations introduced by the government in the area. Adoption of all three has been limited by initial cost and returns to investment. The plow is restricted by the hilly and stony nature of many farms, by small dispersed holdings, and in valley areas, by the heavy clayey soils. Artificial fertilizers are limited by the need to apply limited supplies of organic matter in conjunction with them to prevent loss of soil texture and quality. The introduction of new seed varieties is limited by the different requirements of these varieties, often demanding more cultivation and a more regular and abundant supply of water than poor years can supply, and thus increasing the risk of failure for the farmers who use them.

Yet, when farmers see an economic advantage to available technologies they tend to experiment with and sometimes adopt them. This has been the case in recent years in Tenga where farmers have spontaneously planted experimental plots of the American dwarf sorghum, distributed in a food

relief program. Good results in 1976 for a few farmers led to large numbers trying it in 1977, and requests for supplies of seed. The bicycle is considered to be a mark of prestige among the Kusasi, and is a new technology eagerly adopted by them to increase the distance and ease with which they can commute to wage laboring jobs and markets, as well as to visit relatives. Despite difficulties the plow, too, remains popular.

Evaluation of the potential of technological innovations in Kusaok should center around the economic value to the farm household in terms of the kind of cost/benefit analysis that farmers themselves do informally in order to assess the desirability of such technology.

Population densities in Kusaok and other intensive areas of the Mole-Dagbane region are higher than in extensive farming areas, and where densities for traditionally intensive farmers decrease, they take up more extensive methods. These observations, similar to those elsewhere in tropical Africa, suggest an important causal role for population density in the process of agricultural intensification. Intensive methods are not voluntarily adopted without the incentive of declining food supplies, except in cases of economic incentives, for the decrease in size of holdings as density increases demands increased inputs of labor per unit of land and food product.

There are other ways, too, of increasing food availability that may be more attractive than intensification, especially if the limits of the environment are being approached, and new technologies are either not available or too expensive. As wage labor or crafts and trade opportunities open up with the increase in local government administration and infrastructural operations, Kusasi farmers may be expected to participate in them more and more. Emigration is a method of increasing the supply of food to the emigrant, but its effect on the home community is not always certain. In Kusaok the loss of productive agricultural labor appears to outweigh the return of resources by the emigrant to his home. Indeed, one response to this may be an increase in fertility rates, making up the deficit in labor for intensive agriculture.

In Kusaok it is the pang of the empty stomach and not the lure of market profits that has led to intensification in the past and will continue to dominate for some time into the future. Attempts to introduce cash cropping, reinforced by head taxes, have been an overall failure among small farmers in Kusaok. This is partly because of the farmers' frequently justified mistrust of the cash economy. They prefer, for example, to use livestock as walking bank accounts and hedges against food shortages because of a

corrupt finance sector, rampant inflation, and wildly fluctuating commodity prices. Cash crop enthusiasts in the government and development projects have generally failed to take into account the unfavorable change in risk factors due to adjustments demanded in labor organization, crop distribution, and to corrupt and inefficient government buying organizations, and the depreciating value of cash received for such crops in the face of inflation and food shortages. In Kusaok today the cash return realizable on equal units of land planted to cash crops (cotton or fiber) compared with food crops is much higher for food crops.

Slavery in Kusaok has little in common with European feudalism or the enslavement of Africans in the New World. Slavery was common among the Kusasis, but slaves soon became incorporated into the community, acquiring their own farms. Without the necessity of localizing populations to exert central control for military or exploitative purposes, there is no advantage to using slave labor for intensive agriculture when sufficient land is available for extensive farming, since returns for unit of labor are higher under extensive systems.

Coercive colonial programs were aimed at supplying labor to underwrite development in the south of Ghana and,

secondarily, at decreasing population pressure in the intensive areas through resettlement programs. Nkrumah's attempts at large scale intensification with communal mechanized farms failed to increase agricultural production and undermined efforts to increase the output of subsistence farmers locally.

The most successful programs have been the ones that emphasize demonstrating the advantages of the new method to farmers on their own ground, a point that has been emphasized in northeast Ghana by field and extension workers since Lynn (1937). It has been consistently overlooked by large-scale development projects such as URADEP ever since.

Kusaok is similar to other areas of intensive agriculture in northern Ghana in being associated with high population densities and relatively fertile soils. Probably the most important direct cause leading to intensification is population pressure, while environment, culture, and politics have served to increase population pressures locally by concentrating people in certain areas. While intensive agriculture may have favored a dispersed settlement pattern, social organization was also conducive to small households separated from each other and resident in the middle of their manured compound fields.

It could be that it is only in such relatively fertile areas of rural rainfed agriculture that intensification can occur, and indeed, it is encouraged by the very fertility which would attract migrants and allow for higher population densities at first under an extensive system. Earlier in this century Kusaok was known as a food surplus area (Lynn 1937), and there has certainly been a pattern of decreasing use of bush farms and decreasing length of fallow on those remaining.

While the origins of intensification are difficult to know, we can be more positive about what is happening today. Under the intensive agricultural system in Kusaok and the other intensive areas of northern Ghana, there is increasing population, land degradation, emigration, and food shortage. As suggested by Rose Innes (1977), it may be too late to establish a self-sustaining agricultural system by the time intensification reaches the point it has in northern Ghana, for there is not enough land to incorporate the ley (the field which is rotated through intensive grazing to renew fertility). But even in the extensive farming area of northern Mossi country it may already be too late to stop the process of decreasing yeilds and soil degradation (Marchal 1977).

What else could the farmers do, and why aren't they

doing it? It might seem as though farmers in such a situation could make better advantage of their resources, for example, by more careful control of fires in the dry season, by composting crop residue instead of burning it, by utilization of all animal and human waste, by spending more and more hours in the fields during weeding. There may be several reasons why this is not taking place:

1. The very process of intensification has allowed for an increase in population; public health measures and transport of food have also led to population growth at a rate faster than people can effectively respond to it, especially once land degradation sets in and reduces the return to increased labor input.

2. As food availability per capita begins to fall, agricultural productivity decreases because of hunger, and tiredness during weeding.

3. The market economy provides alternatives to increasing food availability by selling labor or crafts.

4. Emigration drains the local farming communities of their most productive labor.

We suggest that in northeast Ghana and similar areas of rainfed intensive (or extensive) agriculture where land degradation and economic decline (indicated by a high rate of emigration of the productive segment of the population) have already been established, it may not be possible for externally financed development to produce a surplus, i.e., to pay for itself, for a very long time. For if agricultural

intensification is a positive response to increasing population density, it may also indicate a move over the threshold of sustained production toward a downward spiral of increasing poverty and economic stagnation which will only be speeded up by ill-conceived development projects that demand a relatively short-term return on investment to bolster a sagging national economy. In Kusaok and much of the rest of northern Ghana and Upper Volta, it is necessary to initially subsiduze development with inputs of food, credit, capital supplies, and land (resettlement) until farmers are no longer hungry.

The Hausa of Nigeria. The Hausa are a major ethnic group in West Africa, forming the predominant population of northwestern Nigeria, especially in Kano, Bauchi, Kaduna, and Sokoto States. There is considerable Hausa settlement (Fig. 1) in Niger as well, and Hausa traders take part in an extensive commercial network reaching into southern Nigeria, Benin, Upper Volta, and Ghana. Hausa agriculture relies on a fairly standard inventory of Sudanic crops, but both shifting and intensive methods are used, varying in their relative proportions in different regions and even in the same community at different periods. Differential access

to traditional cities and trade networks also characterizes various rural settlements. A wealth of recent studies by geographers, economists, and anthropologists allow both controlled comparisons within and among regions and some measurement of changes in agriculture through time.

The Hausa language is widely spoken as a lingua franca in the Sudanic region of West Africa, and Hausa is a part of the Afro-asiatic family of languages also including Berber, ancient Egyptian, Cushitic, and Semitic. An indigenous literature exists using Arabic characters to write the Hausa language. Most Hausa are Muslims as a result of conversion beginning in the fifteenth century and culminating in the conquest of the seven traditional Hausa states by Fulani religious leaders and Islamic scholars shortly after 1800. Hausa society has a long history of political centralization under kings or emirs ruling large, sedentary rural populations from cities with well developed administrations, systems of courts, and a military organization. The markets of cities such as Kano impressed the first European explorers in the nineteenth century with their large range of crafts, their use of cowries and other currencies, and the evidences of extensive caravan trade across the Sahara and connecting the Hausa with the traditional empires from Lake

Chad to the Niger bend. Unlike neighboring groups in independent communities or tribal enclaves, the rural Hausa have long been true peasants, socially and economically integrated members of a state. "Tax collectors and traders have for centuries been transporting the rural surpluses to the political capitals, and the tradition of surplus production for distant centers of consumption, through trading, taxation, and levies is deeply important" (Forde, quoted in Hill 1972).

When northern Nigeria was defeated and brought under British colonial control by Lugard in 1900, the characteristic settlement pattern of compact walled towns ringed by bush hamlets persisted. These territorial units continued to be administered by community chiefs responsible through various ranks of superiors to the head of state. The British policy of indirect rule officially accorded recognition to traditional chiefs and the existing framework of Hausa-Fulani government (Smith 1960). The settled, farming Hausa have long lived in symbiotic contact with Fulani nomadic herders, and those Fulani who settled in towns have intermarried with Hausa, becoming indistinguishable from them in dress and language (Hill 1972:3). Other non-Islamic ethnic groups were formerly assimilated into Hausa society by means of slavery, and Hausa culture continues

to attract outsiders to a distinctive ethnicity based on common religion, language, a hierarchical polity, urban-rural relationships, a relatively well developed economy, and a large population with considerable political influence in modern Nigeria.

Hausa farmers live in a savannah environment with pronounced dry and wet seasons where they grow cereal crops of millet and sorghum supplemented by cowpeas, peanuts, cotton, and vegetables. Hand labor predominates with the short-handled Sudanic hoe as the principal tool. Agriculture provides both subsistence needs and cash.

Because most Hausa crops depend on natural precipitation, the amount and timing of rainfall is crucial to the agricultural system. Annual totals vary from 103-154 cm. (40-60 inches) in the southern part of Hausaland to 51-103 cm. (20-40 inches) in the north (Buchanan and Pugh 1955:26). Much of this falls during the April to October wet season, and the winter months of November through March are almost totally rainless as the climate is dominated by dust laden winds from the north and dry Saharan air masses. Early and late rains of the wet season often come as short, violent storms, and normally dry water courses may fill and flood. With declining total precipitation in the north, rain may be localized and

increasingly variable in both annual and monthly distribution with greater possibilities of crop failure (Mortimore 1967). Drinking water is obtained from perennial streams or individual household wells. Low lying marshy areas with insufficient drainage allow the continuation of farming into the dry season. Temperatures rarely fall below 42° F, and thus they are suitable for plant growth the year round (Goddard et al 1971).

Despite the low esteem in which tropical soils are often held, the Hausa area appears to have reasonably fertile and easily worked soils. The Nigerian plains, "lying between the deserts to the north and the forest to the south, are analogous to the loess belt of Europe. Both have long been zones of easy movement, both are unusually productive and owe their fertility at least in part to soils derived from wind-and water-laid deposits that accumulated under climates differing markedly from those of the present" (Grove 1961). The drift deposits deriving from the desert sands of the last arid period are variable in depth and become finer in texture towards the southern margin. A band paralleling the northern border of Nigeria has coarse light sandy soils of buff or reddish color which are well suited to crops such as millet and groundnuts. Around Kano these freely draining sandy loams

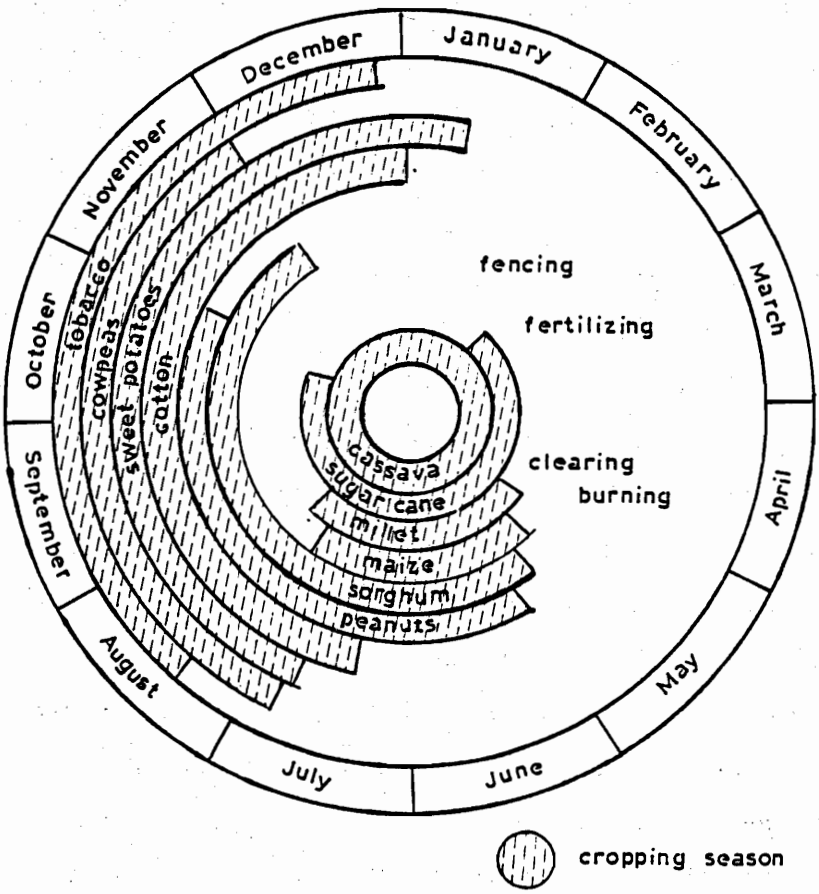
"have proved highly amenable to intensive cultivation" (Mortimore 1967). In depressions and alongside larger rivers there are alluvial and colluvial soils with larger clay/silt fractions and inferior drainage. The Zaria type soils farther south show a finer drifted material up to 14 feet in depth which are heavier and more difficult to work. They become waterlogged after a heavy rain and crack during the dry season, but they are favorable for growing cotton (Buchanan and Pugh 1955:39).

Much of Hausaland is a gently undulating plain 610 - 914 m. (2,000 - 3,000 feet) in altitude with mature streams flowing in broad shallow valleys separated by inconspicuous watersheds (Buchanan and Pugh 1955:18). The Sokoto Plains in northwestern Nigeria are monotonously flat except where trenchlike valleys carry tributaries of the Sokoto River through areas of ironstone surface capping.

The natural vegetation is savannah woodland with low orchard bush and scattered shade trees such as baobabs, silk-cottons, and ficu trees. Human activities have reduced areas of forest to a parklike landscape where trees with some economic value such as locust bean and shea butter are preserved. Vegetation is often used as an indication of soil quality, and trees such as Acacia albida are highly valued

because crops do extremely well beneath them (Luning 1963).

In most of the Hausa inhabited area, the main agricultural activity starts with the beginning of the rains in May (Fig. 15). Fallow land has previously been cleared by cutting trees, uprooting bushes, and burning them. When the earth has been softened by the rain, it is turned with a heavy, curve-bladed short handled hoe or hand plow, making a pattern of parallel ridges three feet apart on the field. Millet and sorghum are sown onto the ridges. Maize is also grown, though it is a less important cereal. The grain crops are often interplanted, and groundnuts may be sown a month or more later in the same field. Weeding done during June and July with a lighter short or long handled hoe is the most demanding labor of the agricultural year. The triangular flat blade hoe is also used for various planting chores and for harvesting peanuts. When a field has been in use for several years, scoops of earth may be removed from the old ridge and deposited in the furrows from the previous year. When the seeds planted in this loose pile of soil have germinated and grown to a height of four to six inches, the old ridges are broken down and piled around the young plants. Both cultivation techniques involve the annual alternation of ridge and furrow



(Schultz 1976:140)

Figure 15. Hausa agricultural calender.

placement (Schultz 1976:138-9). Cowpeas are planted in the grain field during the second half of July, and by early August the millet is ready for harvesting.

Agricultural work tapers off after the end of the rains in October, and the harvest of sorghum, cowpeas, and cotton comes in November and December. Cassava and sweet potatoes may be grown in scattered mound gardens, and the swampy or river bank lands called fadama may support sugar cane, rice, tobacco, and onions. Kitchen garden crops like okra, eggplant, tomatoes, calabashes, and papaya are cultivated within compound walls and between the compounds. Only seasonally inundated land or that near enough to a water course to be irrigated with a shaduf (a bucket and rope attached to a counter-weighted pole) is capable of producing two crops a year or being kept in production during the dry season. Sugar cane may be planted as early as March and not harvested until December (Smith 1955:241). Fadama land is not ridged.

A sample of three Zaria villages indicated that food crops such as millet, sorghum, and cowpeas accounted for almost 60 per cent of the total cultivated acreage (Norman 1977). Major cash crops are peanuts, sugar cane, cotton, and tobacco, but their relative importance varies within the Hausa area according to environmental conditions and market prices. Small holders may delay planting of a cash

crop like cotton because they give first priority to their subsistence crops (Schultz 1976:143).

Mixed cropping with two to six types of plants interspersed in the same field is common in Hausa agriculture. Only some 20 to 30 per cent of total acreage is devoted to pure stands, though sugar cane is invariably planted as a sole crop. Interplanting of this sort (Fig. 16) provides security through diversity, reducing the risk of disease incidence and of total crop failure (Norman 1977). Mixing nitrogen-fixing legumes with other crops (Mortimore 1967) also gives the advantages of an implicit rotation within each year rather than from year to year. Gross returns per acre are higher than those of pure stands by 62 per cent (Norman 1977), and average return per person hour of labor are also superior under mixed cropping. Multiple cropping in which two or more crops are grown in succession on a single plot during the same year also occurs frequently.

Hausa farmers make a fundamental distinction on the basis of the types of land and moisture conditions. Fadama is low-lying land subject to seasonal flooding or waterlogging along the banks of streams or depressions. Upland is always elevated relative to fadama, if only by a few feet (Goddard et al 1975). Because fadama is limited by

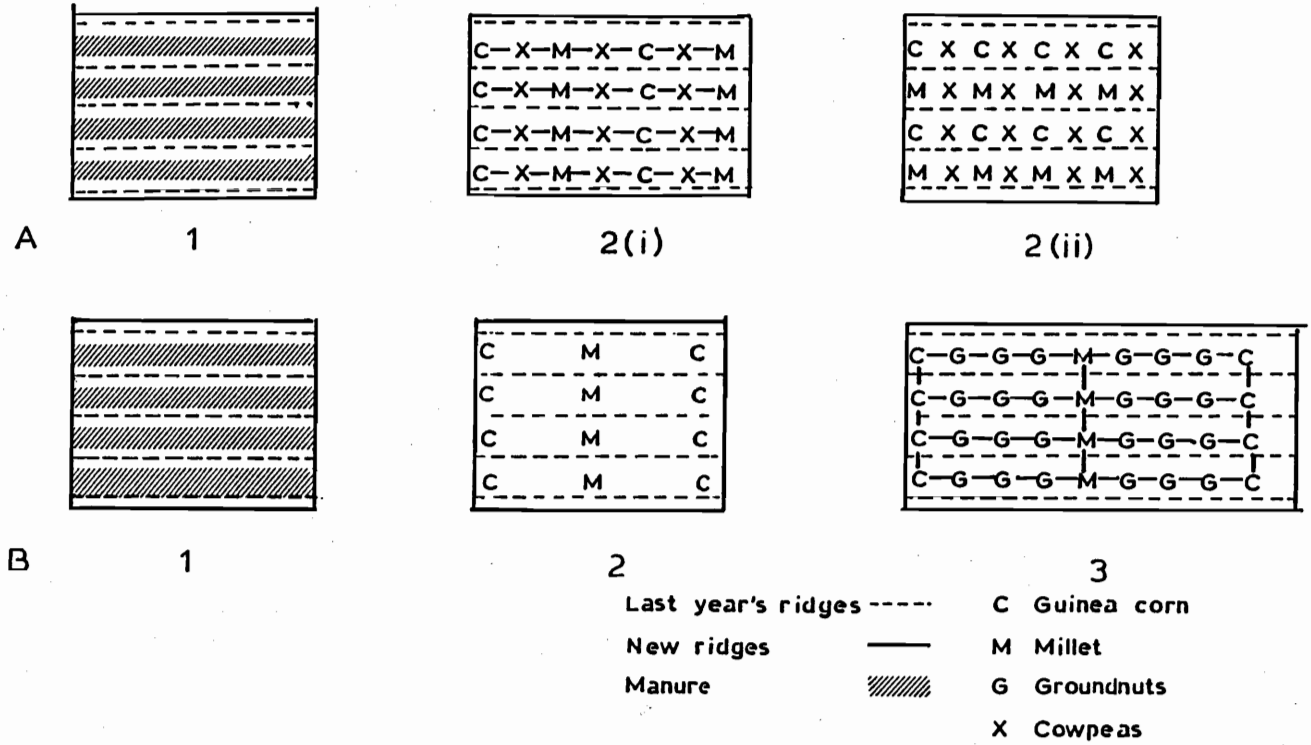


Figure 16. Common interplanting patterns (from Martimore 1967).

the local topography, it rarely constitutes more than 10 per cent of the cultivated area. Where the water table is high, it can be used for cultivation year round, and it often allows the irrigation of dry season crops. Because it supports labor intensive cash crops such as sugar cane, rice, vegetables, and tobacco, and because only limited quantities are available, it has a high value. Upland is used during the wet season only for growing the grain staples plus peanuts, cotton, and cowpeas.

Upland may be further subdivided into infield and outfield types (Schultz 1976). Infield is manured land that is annually cropped while outfield land is fallowed periodically. The organic material applied to infield farms is made up of pen manure (a rotted mixture of animal excreta and straw bedding) and household refuse (non-edible food wastes, ashes of cooking fires, and compound sweepings). It is transported to the field during the dry season in donkey-borne bags or by headload in baskets. Organic material comes most frequently from a family's own compound and animals, but it may be purchased from other villagers or from city dwellers when the farm village is in the vicinity of a large urban center. The contribution of manure from Fulani cattle temporarily corralled on farm plots appears relatively insignificant (Schultz 1976:171).

Farmers recognize that organic material is necessary to prevent the declining fertility of infield land, but they also know that an application of manure leads to rapid weed growth and necessitates a third weeding of the crop (Schultz 1976:184). There is experimental evidence that the addition of two tons of organic material per acre permits annual cropping and a rate of three tons per acre gradually builds up soil fertility. Average application within Kano villages has been estimated at 3370 kg./ha. (1.5 tons per acre) and in the Soba District of Zaria at 12350 kg./ha. (5.5 tons per acre), but only four to twelve per cent of the infield plots may receive organic material in any one year (Schultz 1976:186, 188). Outfield land cultivated without manure depends on fallowing for the restoration of fertility. Short term grass fallows never exceeding two years exist alongside longer term bush rotation fallows (Goddard et al 1975). True shifting cultivation with considerable regeneration of bush and a low proportion of cropped to fallow land represents the least intensive system of land use (Morgan 1969). The same crops and crop mixtures appear to be grown on both infields and outfields with the exception of tobacco which is largely confined to the infield. Most rural Hausa villages maintain all of the above mentioned field systems, but the proportions of

land devoted to fadama, infield, and outfield may vary widely. In the close-settled zone around Kano, the proportion of annually cropped land rises to 85 per cent and the outfield category disappears for all practical purposes (Mortimore 1967).

Field systems have long been recognized as forming roughly concentric zones of cultivation around traditional Hausa villages. Prothero (1957) distinguished permanently cultivated land within the village walls and extending one-half to three-quarters of a mile beyond them from rotational bush fallow one-half to one and one-half miles from the village (Fig. 17). An outer ring with a radius near one and one-half miles around the village was the zone of shifting cultivation. The location of fadama was dependent on the presence of streams and marshland, but that closest to the settlement was likely to be most intensively used (Grove 1961). The locational analysis of differing land use arising from the problems posed by distance and the economies of time and transport required by variations in agricultural intensity follows models of rural settlement proposed by von Thünen (Chisholm 1962). Infield plots receive greater inputs of labor and capital because less time and money are needed to work them, fertilize them, protect them from pests, and harvest their produce.

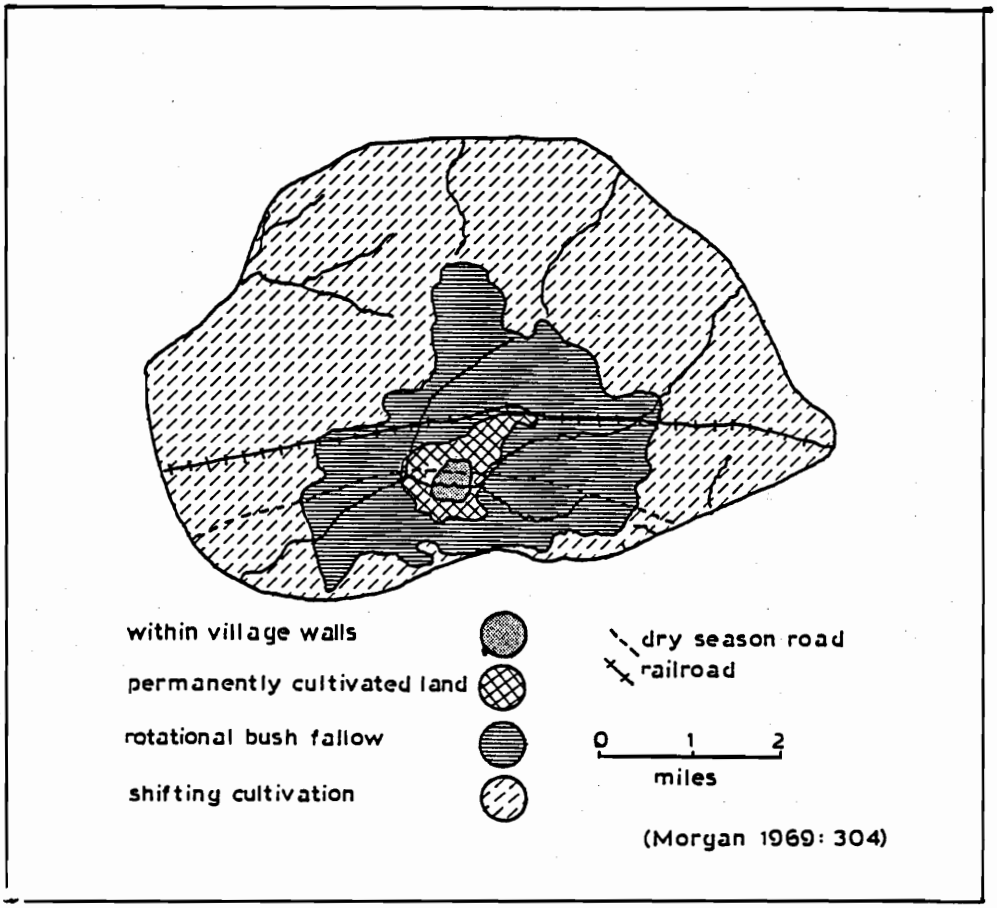


Figure 17. Land use zones at Soba, near Zaria.

The costs of production on the more distant outfield farms are higher, and the returns on the farmer's labor are correspondingly reduced (Morgan 1969, Goddard et al 1975). Transportation costs make the intensive cultivation of the farther fields unprofitable.

Average size of farm holdings varies widely in Hausaland. Hill's (1972:236) summary of 14 studies gives a range from 4.3 to 15.0 acres with the average holding in the survey areas commonly between 4.3 and 8.0 acres. Such findings are subject to error because of the difficulty of defining households that control land and the treatment of farms in fallow. Surveys in Sokoto (Goddard et al 1971) contrast three villages with average hectarages of 4.3, 2.7, and 2.25 (10.61, 6.68, and 5.56 acres) respectively, and three Zaria communities show a similar range of 4.8, 4.0, and 2.2 ha. (11.9, 9.8, and 5.5 acres) (Norman 1977). Average size of holdings near Kano City is 1.3 to 1.5 ha. (3.3 to 3.7 acres) (Goddard et al 1975). Local topographic conditions strongly influence the availability of fadama land which varies from an average of .01 to .1 ha. (.03 to .3 acres) in a six village Zaria study (Smith 1955:226), and the proportion of upland devoted to cash crops goes from 18 to 37 per cent in the same sample.

The sorghum that is a mainstay of the Hausa diet is said to average about 786 kg./ha. (700 lbs/acre) in production with a seeding rate of 17-22 kg./ha. (15-20 lbs/acre) (Hill 1972:224). Agricultural Department estimates (Smith 1955) give the following per acre averages: millet 562 pounds, cowpeas 100, groundnuts 524, cotton 224, sweet potatoes 1224, and sugar cane 10 to 20 tons. Grain yields for Hausa farmers in Niger are only 50 to 70 per cent of those in Nigeria (Raynaut 1976). A Katsina sample gave an average cultivated land per head of 1.3 acres that produced in a normal year 280 pounds of sorghum, 270 pounds of millet, 130 pounds of peanuts, plus some beans, cassava, and maize (Grove 1961). Basic per capita grain consumption is estimated at 318 kg. (700 pounds), leaving a shortfall of food to be purchased on the market. Millet-sorghum mixtures in Zaria provided joint yields of 960 kg./ha. (855 lbs/acre) as opposed to pure stands of sorghum giving 787 kg./ha. (701 lbs/acre) (Norman 1977).

Estimates of dietary intake and nutritional needs for rural Hausa populations vary wildly. One rule of thumb is that a mixed population of men, women, and children require 1 lb. per head per day, equivalent to 1,600 calories. Other calculations put requirements at 2.2 lbs. per day or 750 lbs. annually, and Hill suspects that though consumption

in the poor village of Batagarawa may be only 1 lb. a day, requirements are much above that and the diet of the people is inadequate. The Hausa are not generally thought of as malnourished, but the facts of the matter are unclear.

In a careful study of three Zaria villages, Norman (1977) gives the total annual person hours (adjusted for age and sex) of work on the average farm as 1,753. 240 person hours per year are expended per cultivated acre, and men work an average of 5.0 hours per day. A male adult puts in some 141 days every year on the family farm (Norman 1977:69). Major differences in labor input occur with contrasting field types: whereas 204 hours per acre are devoted to upland fields, lowland fadamas receive 525 hours per acre, an indication of much more intensive cultivation. An adult male using a hoe is judged to be capable of cultivating 4 acres of upland, and labor appears to be the limiting factor during the June and July weeding of grain crops (Goddard et al 1971:34). Where population was sparse and extensive agriculture was practiced in one Sokoto village, 7.16 acres were farmed by each male or equivalent labor unit, but with higher population densities, only 3-3.4 acres are farmed, suggesting that land is the limiting factor (Goddard et al 1971). The amount of labor used per acre is inversely related to the number of cultivated acres on the farm (Norman 1977).

In contemporary Hausaland, women after the age of 15 are largely kept in seclusion according to local Moslem custom. Though they engage in economic activities such as processing food and trading through intermediaries, they do little agricultural labor. In the recent past, women took a more active role in farming (Hill 1972:43), but they are now seen in the fields only in remote settlements (Schultz 1976) and in parts of Niger where they also own significant amounts of farmland (Raynaut 1976).

The social group most significant to Hausa agriculture has been called the "farming unit" (Goddard et al 1971). Most often this is a simple family of a man, his wife or wives, and their unmarried children. It is called in Hausa an iyali and is distinguished from complex units known as gandu comprising two or more married males and usually related to each other as father-sons or brother-brother. Families in the complex units may live together in one compound or apart, but they form a group for food production, consumption, or both. Conversely, a single residential compound may contain several simple or complex units that do not regularly cooperate with each other in agriculture. Simple farming units may develop into complex units as sons marry but maintain economic ties with their father. Complex groups may also fragment as

the head of a gandu dies or as brothers decide to go their separate ways. Hausa social organization is often described as based on multiple family households practicing agriculture with the gandu, and indeed this does appear to be the traditionally preferred form of basic production-consumption unit. The gandu worked a common field under the direction of the gandu head who provided taxes, marriage expenses, and daily food for the other family members. Somewhat less inclusive forms of organization were the land gandu with a communal field and production but with subordinate members paying their own taxes and the cooperative gandu where land is held by individuals, communal farming operations are largely voluntary, and members provide their own food and tax money (Goddard 1973). In Zaria and Katsina where land is not yet in short supply, gandu composite units comprise about 30 per cent of all farming units and contain 47 - 54 per cent of all married men. In more densely populated Sokoto, only 19 per cent of the units are in gandu form, and these tended to be of the cooperative type where neither property nor produce was held in common (Goddard et al 1975). Gandu organization obviously depends on the availability of sufficient land to employ and reward the labor of members. Among Zaria small farmers with an average

of 5.5 acres, 63 per cent of the farming units were simple. Large farmers with an average of 17.2 acres had 48 per cent of their households as gandu. Looked at from the other direction, composite family units had average holdings of 17.7 acres compared with 7.1 acres for the simple family type (Norman 1977).

The gandu farm was traditionally held collectively by the group, and members worked four days a week on it. Individual family heads were also allocated private farms which they and their children cultivated on other days and in the evenings. Among certain pagan Hausa, the grain from the special gandu granary was used to feed all families during the agricultural season, but during the dry months, the gandu members with private farms provided their own subsistence and took turns feeding the gandu head (Greenberg, cited in Hill 1972:39). Today gandu farms are effectively owned by the father, the granary is not necessarily closed during the dry season, and fathers may or may not give land to sons who decide to leave gandu (Hill 1972: 49). The proceeds from craft and other off-farm activities always belong to the individual (Goddard 1973). Such income becomes more important where there is a large and increasing rural population with attendant land shortages, and there is also less produce to meet food requirements of a large

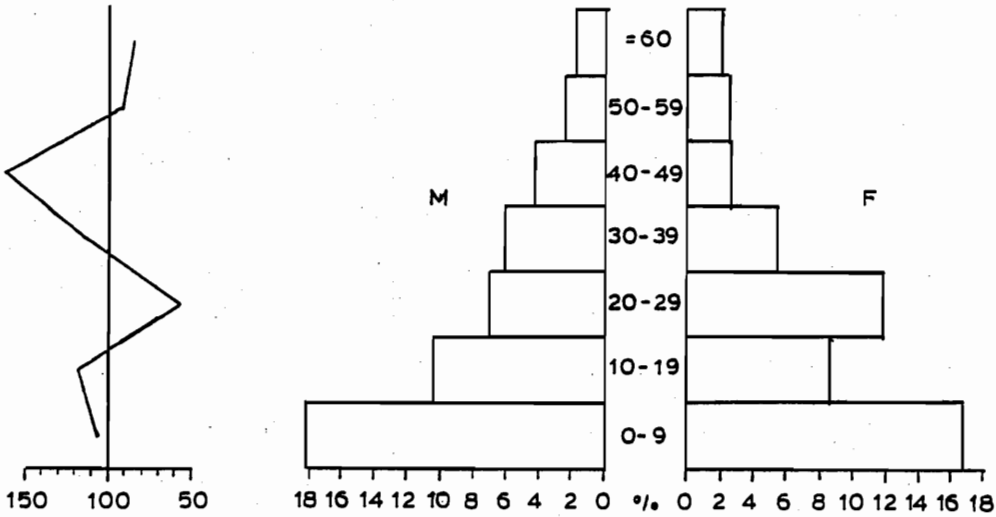
family (Goddard et al 1975). With growth in the money economy and the availability of consumer goods, young men are more concerned with earning cash, and less subject to the risks of crop failure from which gandu membership gave partial security (Goddard 1973). As members work less in gandu and derive fewer benefits from it, the structure of the composite farming unit weakens, and both its incidence and economic importance declines.

Because population figures determine relative political representation of regions within Nigeria and federal revenue sharing, they have been a source of bitter dispute at the national level. Serious questions have been raised about the accuracy of the last two censuses, but there is no doubt that population growth is rapid. The total for the three northern states with the largest Hausa populations has gone from 9.15 million in 1953 to 15.6 in 1963 and 26.19 in 1973 (Arnold 1977:178). Though the military government has cancelled the results of the 1973 census, it would appear that the Hausa are growing at a rate in excess of the 2.6 per cent per annum characterizing the country as a whole.

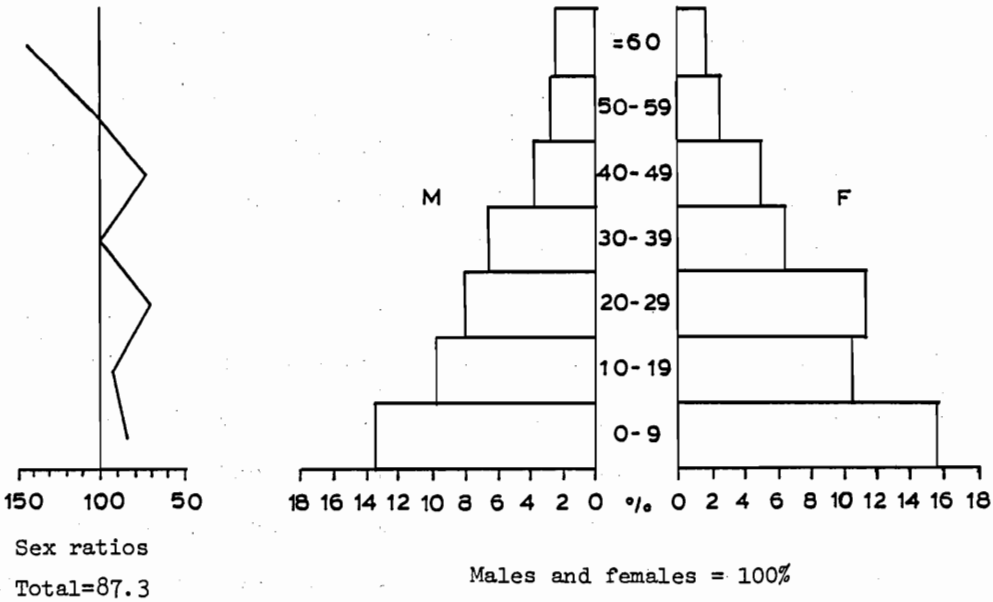
Dependable fertility and mortality rates are not available for Hausa populations. One comparison of completed fertility in two Zaria villages gave average number of live births in one as 8.1 and in the other as 3.99,

suggesting biased data (Smith 1955:173). More accurate may be the estimate of 54 per cent of all live births surviving to reproductive age and an annual rate of population increase of 2.6 per cent (Smith 1955:174). The age-sex structure of local samples (Fig. 18) resembles that of other rapidly growing countries with about 50 per cent of the population less than age 20 (Norman 1967:5). Marked tapering of the pyramid after age 50 plus the high infant death rate suggest a fairly low life expectancy (Goddard et al 1971). In total populations, the numbers of males and females are practically balanced, but the relative absence of males in the 10 to 29 year age group may suggest outmigration, appearing as it does in the Sokoto but not the Zaria figures (Goddard et al 1971:9, Norman 1967:9). Men sometimes outnumber women in the age groups above 30, perhaps because women have the greater health risk of childbirth.

Local growth is based not only on natural increase but also on migration. Hausa farmers appear to move readily, becoming acquainted with new areas during seasonal labor migrations and responding to drought or local land shortage by taking up residence in more favorable environments. One Katsina district with limited land resources lost population between 1939 and 1951 while less densely settled areas



A. HANWA (Total = 723)



B. Dan Mahawayi (Total = 663)

Figure 18. Population pyramids and sex ratios of two villages in Zaria (from Norman 1974).

were growing by 50 per cent. The dry season exodus from Kano is 10 per cent in a good year and 60 per cent when the harvest is bad (Grove 1961). Where cash crops grow less well and access to the local urban market is limited as in Sokoto, 25 to 65 per cent of the male population 15 - 49 may go on dry season labor migrations, many traveling hundreds of miles to western Nigeria or Ghana (Goddard et al 1971).

Within the Hausa inhabited areas, there is considerable variation in the size and density of local populations. Though parts of southern Zaria may have no more than 50 people per square mile, the Kano close-settled zone with a radius of 25 miles from the city contains about 2.4 million with an average density of 500 per square mile, excluding Kano itself. Comparative studies of village areas in Zaria (Norman 1967), Sokoto (Goddard et al 1971), and Kano (Goddard et al 1975) use household survey methods to derive accurate counts for the districts considered. Sampled villages range from averages of 81 per square mile to 709. A historic change in local population has been charted in Schulz's 1976 restudy of the Soba area of Zaria earlier documented by Prothero (1952). We will discuss below the factor of population density as it correlated with agricultural intensification.

Variations in population density correlate in part with climatic factors. Toward the north along the present Niger-Nigeria border, mean annual rainfall declines to 20 inches and crop failure becomes more frequent. Population also thins along the southern fringe of Kano Emirate and in Zaria where dense woodland is infested with the tsetse fly carrying sleeping sickness. But the same area was also depopulated by slave raiding in the nineteenth century, and a long history of conflict accounts for the sparse settlement of the area between Sokoto and Katsina (Grove 1961).

Nucleated settlement patterns with walled towns and a hinterland of bush hamlets have been characteristic of Hausaland. In contrast, the very densely populated land around Kano has both small towns of 1000 - 1500 inhabitants and dispersed compounds with many farmers living amid their neatly hedged infields (Mortimore 1967, Hill 1977:4). This departure from tradition may relate to economies of distance and to the requirements of intensification. A farmer living on his own plot may devote more continuous effort to it, manure it more easily, time agricultural activities more precisely, and protect his maturing crops more adequately. Where land is individually held and worked, nearby residence also asserts a stronger claim to possession of the scarce resource (cf. Netting 1969).

Another distinctive feature of the Kano close-settled zone is the existence of "big houses," large compounds with as many as 20 constituent families and over 100 members. These do not represent land holding units or single gandu but rather related households individually cultivating their own farms and maintaining a common residence because of lack of alternative building sites, the provision of security for some dependent members, and the encouragement of internal trade and economic cooperation, especially among secluded wives (Hill 1977:180-99).

Hausa farmers have never been totally subsistence oriented. The food and fiber crops they produced always entered the market to some degree, rural handicrafts were widespread, wage labor was practiced, and most men had secondary, non-farm occupations (Smith 1955). The need to pay taxes and to buy cloth and other domestic and imported goods meant that all households had to have some source of cash. Agricultural goods had a market value, and their production could either complement or compete with other income-producing activities.

A major determinant of the relative profitability of alternative work opportunities in rural areas is accessibility of the market and the size of the population served by it. Large population centers developed around

nodes of trade that were often also political capitals. Settlements on trade routes could participate in commerce and take advantage of protected movement and regulated exchange in regions controlled by major urban centers. The Pax Britannica extended this area of free movement, and the railroad completed in 1911 connecting Kano and Lagos allowed northern peanuts and cotton to enter world commodity markets. The extension of the road network allowed trucks to evacuate produce, and as all-weather roads were built, especially in the last 30 years, traffic could continue even during the wet season.

The rapid rate of growth in cash crop production among the Hausa in this century owes much to the stimulus of improved transportation and a favorable marketing situation. Growth in exports required both increases in labor hours and in the area of land cultivated by each farmer (Stryker 1976). Peanuts were in demand as a source of edible oils in Europe and they were sold through a state marketing board, but when the local free market price is higher than the official price, Hausa farmers simply cease selling to the state buying stations (Schultz 1976:278). In one part of Zaria, farmers decreased their cotton acreage between 1952 and 1975 because their labor inputs were not justified by prices set by the Northern States

Marketing Board (Schultz 1976:276). In the same area there was a pronounced increase in tobacco production, despite the labor required for preparation of seed beds, transplanting, weeding, and drying operations in addition to cultivation. These very intensive practices were accepted and commercial fertilizer was purchased because prices offered by the Nigerian Tobacco Company made them profitable. Extension services and an organization of production through Master Farmers who contracted with the company for tobacco were successful for the same reasons. Hausa farmers have demonstrated their eagerness to grow cash crops and their responsiveness to differential price incentives. Economic factors influence crop selection and the proportion of the various crops grown, but they do not radically alter the traditional agricultural system.

Increased exchange of food crops has accompanied the improvement of the transport network, and local specialization has become more evident. Kano farmers have found it more advantageous to grow peanuts for sale and purchase food grains rather than attempting to be self sufficient (Mortimore 1967). Where fadama land is in good supply, garden vegetables may be grown or rice and sugar cane produced, depending on distance and cost of transport to urban markets. Even bulky, low value goods may become

profitable in the zone around the largest cities. It is estimated that 15,000 donkey loads of firewood per week move into Kano. Much of this comes from farm trees within a ten mile radius, and on the return trip the donkeys carry city manure back to the land (Mortimore 1967).

Though only major towns may have permanent stores retailing manufactured goods and a large daily market, many smaller villages have twice weekly markets with a variety of goods and services offered. On the periphery of large cities like Kano, secondary market centers may be rare, but a fair amount of trade takes place between and within individual compounds.

A great profusion of secondary employments characterize the Hausa, and they provide a significant part of the incomes of most farmers. Craftsmen, including weavers, dyers, blacksmiths, potters, butchers, mat makers, tailors, and leatherworkers, abound. Religious teachers, government officials, barbers, and drummers provide services. Traders may specialize in anything from cloth to kola nuts, and a variety of brokers handle sundries, food supplies, and livestock. Many men have several occupations. Where a village is relatively inaccessible to a city but has its own market, the emphasis may be on these kinds of traditional manufacturing, service, and merchant functions. In high

density areas near cities, opportunities also exist in the modern sector for commission agents, drivers, messengers, and night watchmen. Such jobs are preferred as more remunerative than work in the traditional occupations (Goddard et al 1975). Secondary employments may actually be decreasing because of a declining demand for craft goods and the failure of rurally based long-distance trade (Hill 1972:190).

Hired agricultural labor is not uncommon, either paid by the hour or contracted with an agreed upon fee for the job. Communal work parties rewarded by a meal or a drink appear infrequent (Norman 1977). Hired labor is used throughout the year in a pattern similar to family labor. It is not specially mobilized for peak periods because there is no class of landless laborers to fill that demand and because the level of cash resources for most farmers is low during that period (Norman 1977). The wage rate for non-family labor remains the same throughout the year. So-called managerial farmers with income from salaried or business positions depend principally on hired labor and on land acquired by lease or purchase (Schultz 1976:266). Dry season migrants must necessarily seek wage work outside of agriculture in most cases, but Kano farmers sometimes compensate for their own land scarcity

by renting unused fadama in the hinterlands and growing irrigated crops.

Dependable information on household economics is difficult to collect, but students of the Hausa have attempted to compile such budgets through individual detailed interviews (Smith 1955:121-149) and through third-person estimates of comparative economic standing within the village (Hill 1972:59). As expected, there are substantial differences in average income among villages, among individuals within a village, and in source of family income. Mean gross income for work units in seven sample Zaria communities was £60 with a range of £43 to £74 (Smith 1955:148). The proportion of this gross income derived from subsistence production alone varied from 33 to 65 per cent (Smith 1955:138). A more recent study of three Zaria villages (Norman 1977) gave average gross income in Nigerian pounds at 104, but small farmers (average 5.5 acres) had total family incomes of 65 while larger farmers (average 17.2 acres) had incomes averaging 134. Livestock income was negligible in both cases, but small farmers were more dependent on off-farm income, deriving 34 per cent of their income from such sources as compared to 20 per cent for large farmers (Norman 1977:79). Hill (1972:59 ff.) found that poorer farmers worked more

as farm wage laborers, owned less manured farmland, produced less food, and suffered from hunger under drought conditions, indicating significant economic inequality within the village. The fact that most family incomes are low and that savings are very limited probably makes the quest for security and a conservative attitude toward change important components of agricultural decisions (Norman 1977).

The British policy of indirect rule in Northern Nigeria after 1900 sought to continue existing political machinery and maintain peace and order with an absolutely minimum investment of capital and manpower (Hill 1977). This meant in practice that there was little control of rural areas and that knowledge of Hausa agriculture and population was often lacking. Though the British collected taxes and decreed gradual freedom for slaves, their major contributions to the economy were (1) the elimination of local warfare allowing the movement of trade goods through a wider area and the settling of land previously exposed to raiding, (2) the creation of an infrastructure of roads and railroads linking Hausaland with the southern ports, and (3) the stimulation of private trade in agricultural commodities, particularly peanuts, and foreign manufactured products. Agricultural research was begun at

the Institute in Samaru, but only a few large-scale agricultural development schemes such as mechanized rice growing in Sokoto were attempted (Meek 1957). Crops entering the market were produced chiefly by traditional methods and tools with the government providing only buying stations.

The only major innovation encouraged by the colonial regime was the ox-drawn plow, intended to save labor and provide manuring among Hausa farmers who were erroneously presumed to be mainly shifting cultivators (Hill 1977:307). From first plans in 1924, plow-using farmers increased to 621 in 1935, 1447 in 1937, 7000 in 1950, and 40,000 in 1965. The technique requires substantial capital for plows and a pair of oxen, and government loans were instrumental in the first stages of its adoption (Hill 1977:308). Plow owners tend to be wealthier members of the community and to acquire plows largely for hiring them out to others.

Information on agricultural policy in modern Nigeria is not easily accessible, but it appears that the basic production systems of the Hausa continue to operate with little change. Increases in plowing and the use of chemical fertilizers are coming about through rural communication networks and the operation of the market economy as well as through agricultural extension efforts. Permanent

cultivation is still little appreciated by outside experts, but a series of excellent studies relating local cropping systems to population, land tenure, household organization, and alternative employments have been prepared by Mortimore, Goddard, and Norman working under the Institute for Agricultural Research, Samaru, which is affiliated with Ahmadu Bello University in Zaria.

Having established that permanent cultivation of manured farmland is an old, stable, and common agronomic system in Hausaland, Hill (1977:303-305) contends that this is due to a strong preference of farmers for this type of cropping, regardless of population density. Aerial photographs indeed show evidence of annually cropped farms even in areas with a population density under 50 per square mile, and new settlers plan infields near their compounds even when a wealth of land for shifting cultivation is available to them (Schultz 1976:310). However, when asked to choose between infield and outfield plots, Hausa farmers split almost 50/50 in their preferences (Schultz 1976:209). Unless forced to select one category, most informants would apparently have preferred to cultivate both. Only when the sample is broken down by population density do differences appear. Among those living in areas with densities under 100 per square mile, there was

a strongly marked preference for outfield cultivation, while farmers in villages with populations over 200 per square mile found infields more desirable (Schultz 1976:210). It appears that farmers' perceptions are influenced by the requirements of their particular field system which is in turn contingent on relative scarcity of land. Though some permanent farms are found around all Hausa settlements, their relative proportions as a percentage of cropped land vary directly with population density. For example, 15 per cent of cultivated acreage around a low density village in the Soba area was infield, while a nearby medium density village had 40 per cent in the same category (Schultz 1976:241, 285). Without comparisons of this kind, the effect of generalized cultural values on the farmer's behavior and decision making under various constraints cannot be judged.

This is not to say that Hausa cultivators approach some abstract economic rationality in their activities. Religious and cultural prohibitions on adult females leaving their compounds certainly decrease the amount of labor available during critical periods of the agricultural year. The Moslem pork taboo effectively prevents the raising of pigs. The high value placed on married sons remaining in gandu with their fathers may hinder individual initiative and the

most profitable allocation of labor, though there are indications that the importance of the composite work group indeed declines with population pressure. The assumption of rigid cultural rules that prevent adaptive agricultural change and decisively hinder economic flexibilit is not borne out by comparative, quantitative studies.

Intensification by traditional methods is everywhere limited but almost never prohibited by the physical environment of Hausaland. The seasonality of rainfall constrains the production of most of the land area, and there are definite topographic limits on the amount of lowland that will support crops through a high water table or irrigation in the dry months. Unpredictability of precipitation means that planting may be delayed, labor idled, and yields substantially reduced by factors completely beyond the farmer's control. The drift soils of northern Hausaland appear to provide distinct advantages of fertility and ease of cultivation, but they do not establish hard-and-fast limits on the areas suitable for agriculture. The historic movement into areas of sparsely settled bush, the rolling back of the tsetse fly belt, and the expansion of infield zones onto less favorable soils all attest to the possibilities of increased production from existing resources

BEST AVAILABLE

The organic status and texture of soil along with its irregularities of slope may indeed be improved by manuring, hoeing, and the construction of simple drainage ditches that are regularly employed in Hausa infields (Schultz 1976:286). There is also evidence that fadama is being more completely utilized, and those areas that lack lowland may water vegetables from shallow wells.

Different regions obviously have different potential for intensification. Once the reserve of uncultivated land is exhausted, if shifting cultivation continues and the fallow is not replaced by increased inputs of fertilizer and manure, serious degradation of the land may take place. Intensification is not automatic, and in drier areas such as northern Sokoto, there may be a critical density of 200 - 250 per square mile beyond which deterioration may set in. The unfavorable environment and the lack of sufficient manure in the area means that insufficient land can be kept under annual cultivation and yields are low and declining, unlike the Kano close-settled zone (Goddard et al 1975). Areas with these conditions and an absence of lowland often become exporters of migrant labor as an alternative to intensification.

When expansion of infield cultivation is checked by the unavailability of fertilizer and the fallowing of

outfield reaches minimally practical levels, village land use reaches a threshold (Schultz 1976:297). These limitations are usually met by the movement of farmers to less densely settled areas where their existing agricultural system can be perpetuated. Change to a close-settled zone permanent cultivation system may only take place when (1) land scarcity restricts movement and (2) the local terrain can sustain intensive use.

Agricultural intensification, as we have noted above, is not primarily a result of technological change. The use of organic fertilizers, crop mixtures, and multiple weedings to keep infields in annual production are all traditional Hausa techniques. Farmers have their own extensive, practical classification of soil types, land forms, and naturally occurring trees, and this knowledge is used in making decisions on field location and crops. Riverside seasonally inundated areas and marshlands are also brought into permanent use for dry season crops or successive plantings in the same year. Again the major tools are the locally made hoes, and water control is achieved through ditches, the shaduf, and shallow wells. These indigenous intensive systems have shown the capacity to extend from subsistence crops to peanuts, tobacco, sugar cane, and vegetables for which there is market demand.

Because of the "primitive nature of farming technology" as compared to the small-scale technology of Eurasia, Hill (1977:101) sees no possibility that the developing pressure of population on the land in a close-settled village near Kano might have led to a general intensification of agriculture. Though this area already has a very high level of permanent cultivation and is now beginning to grow well-irrigated onions on manured plots from which early millet has been harvested, Hill believes that the absence of labor saving devices and the "profound inefficiency" of other methods make intensification unlikely. Her data indicates, however, that a high degree of sustained production has already been achieved by heightened labor inputs, and that these may well have reached the stage of "agricultural involution" (Geertz 1963) where marginal productivity declines disastrously. To the extent that chemical fertilizers are easily available through market channels and their application is profitable for farmers with little capital, some increase in yields may take place, but it is not self-evident that mechanical technology alone could achieve a more favorable cost-benefit ratio. Animal traction and the plow have probably not been adopted in the most densely settled rural areas because the fields are too small for their efficient use and areas for forage

are limited (Grove 1961, Goddard 1972). Only richer farmers with larger farms and extended family households can command the capital necessary to purchase oxen and equipment (Tiffen 1973). Where these constraints do not apply elsewhere in Hausaland, plow technology spreads rapidly and spontaneously.

Given environmental limitations and seasonal labor bottlenecks, there is limited potential for increasing income by reallocating the resources now committed to production (Norman 1977). Applied agricultural research should concentrate on testing new seeds, herbicides, and possibly small power tools under actual farm conditions with all operations undertaken by the cultivator. These experiments would allow more accurate judgements on how maximum profitability could be combined with the minimization of risk (the standard deviation of returns) so crucial to the calculations of the average farmer (Norman 1977).

The technological change that has already had the most influence on agriculture has been that of the developing infrastructure. Roads, truck transport, and marketing systems have elicited both increased production and new kinds of crop specialization. Labor movements and the opening of new lands have been facilitated. To some extent, this may have promoted the extensification rather than the intensification of agriculture as plentiful land makes

shifting methods at least temporarily profitable (Netting 1968). On a local basis, distance may become a less important determinant of relative intensification. The necessary extra labor may be applied to fields several miles from the village center when the farmer saves travel time by riding a bicycle (Schultz 1976:311). Intermediate technology such as the bicycle and the plow may well propagate itself more rapidly through governmental improvements in infrastructure than through specific programs.

There can now be little doubt that among the Hausa as elsewhere in tropical Africa there is a broad correlation between population density and the intensity of agriculture. "The greater number of people both require and allow farming to be more intensive" (Grove 1961). The close relationship between density and land use is evident in studies of villages in particular areas where physical environment was held constant and population density was the independent variable. A comparison of three northern Zaria villages (Fig. 19) shows that as population per square mile goes up, the factors of average size of land holding and land farmed per resident decline. Land scarcity is compensated for by decreasing the percentage of land in fallow, increasing the application of organic fertilizer per acre, and increasing total annual person hours of work.

	Villages		
	A	B	C
Population/mi.^{2}	81	396	709
Land			
Average size of holding (acres)	11.9	9.8	5.5
Land farmed per resident (acres)	1.9	1.3	0.6
% fallow in holding	21.2	26.8	2.6
Labor			
Total person hours of work on average farm	1516	1634	2109
Inputs per cultivated acre			
Organic fertilizer (tons)	0.4	0.5	1.5
Person hours - upland	149.8	193.3	349.8
fadama	458.2	462.5	745.8
Income			
Net income per acre (shillings)	131.3	169.1	277.5
Disposable income per resident	290.6	227.5	214.9
Composition of total income (percent)			
Farm	76.2	87.6	65.8
Off-farm	23.8	12.4	34.2

Figure 19. Population, land, labor, and income in three Zaria villages (from Goddard et al. 1975:329).

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Labor inputs per acre are always markedly higher on the intensively tilled fadama land, but both upland and fadama work rises with population. The results of the process of intensification can be seen in the changing proportions of land use types in Soba, Zaria as population doubled between 1950 and 1975 (Fig. 20). Though all types of cultivated land increased, the rates of change in infield and fadama were much more rapid than those of outfield or fallow. Outfield was being steadily converted to permanent use, and the fallow periods of remaining outfields had become shorter (Schultz 1976:290). Agronomic potential has not changed, but the pressure of population has shifted agricultural practices in the direction of greater intensity.

As the demand for land increases, so, understandably, is change introduced into local land tenure and the extent of permanent transfers. Three Sokoto villages (Fig. 21) show holdings shrinking in inverse proportion to population and a regular rise in the percentage of land obtained by purchase and the price per acre (Goddard 1972). Communal land disappears, and the village head has no land to allocate to immigrants. Sale has been common in the Kano close-settled zone since before 1900. Field boundaries are marked by thatching grass or henna bushes (Goddard et al 1975). Though legal rights to land may be usufructuary,

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	1950		1975	
Estimated population	2000		4000	
Estimated density/mile^2	103		300	
Land use type	Acres	%	Acres	%
Urban and residential	70	1.4	230	4.5
Infield	480	9	940	18
Outfield	960	19	1260	25
Fadama	15	0.2	140	2.7
Uncultivated/Fallow	1715	33.4	2000	39
Heavy bush	1880	37	550	10.8
Total	5120	100%	5120	100%

Figure 20. Land use in Soba village (from Schultz 1976:285).

Village	Population Per	Population Km^2	Average Holding-size Acres	Average Holding-size Ha.	% Purchased	Price (N₦) Per acre	Price (N₦) Ha.
Gidan Karma	322	124	14.82	5.43	19.06	3.27	8.08
Takatuku	538	208	7.18	2.87	23.20	7.22	17.83
Kaura Kimba	557	215	6.68	2.67	29.39	7.84	19.36

Figure 21. Land tenure in three Sokoto villages (from Goddard 1972).

	Pop. density per sq. mi./ farmland	Accessibility to city	Upland/ fadama ratio	Migrants as % of men 15-49
Kaura Kimba	557	6 mi. away	1.60	16.13
Takatuku	538	11 mi., on main road	41.85	45.26
Gidan Karma	322	22 mi., no motor road	57.89	65.90

Figure 22. Accessibility and migration in three Sokoto villages (from Goddard 1972).

as the resource becomes scarce, tenure is individualized in practice if not in law. One result is that the degree of economic inequality among farmers becomes more pronounced (Hill 1972, 1977; Norman 1977). Immigrants from high density areas are often willing to rent or buy land. Thus the Kano and Plateau people entering the Soba area introduced changes in local land tenure and at the same time set an example of highly intensive cultivation on limited plots (Schultz 1976:291).

When some members of the community lack sufficient land to meet their needs for food and cash, they may either intensify its use or seek supplemental income from other sources or both. Cottage industry becomes increasingly important when individuals have inadequate land. An association has been noted between weaving and small holdings near Kano (Mortimore 1967), because weaving requires less capital than the purchase of additional land. The percentage of families deriving some income from secondary occupations goes from 48 in an outlying village to 100 within 5 miles of Kano where population density is 609 per square mile (Goddard et al 1975). There is almost more emphasis on growing peanuts for the market in the central village. In Zaria, large farmers in one community spend less time in off-farm occupations and use a larger percentage of hired labor than do small farmers (Norman 1977).

If demographic factors appear to push the Hausa into agricultural intensification, economic factors may support this tendency or run counter to it. A profitable cash crop may require very intensive means for its cultivation, even when land remains reasonably plentiful. A change from growing cotton to producing tobacco might lead to more emphasis on manured infield, even if population and all other factors were held equal. Accessibility to market influences net return on crops by affecting travel costs. Sugar cane, for example, is too heavy to transport long distances without motorized vehicles, but a village on a main road can do better using fadama for cane production than engaging in dry season off-farm activities. In Sokoto, the most accessible village to the city also had a high proportion of fadama land, cattle that grazed on riverine floodplains, and the opportunity for dry season fishing (Fig. 22). The village on the road is well situated for trade, and weavers sell their fabrics in Sokoto (Goddard et al 1975). The least accessible village with little fadama land has the highest rate of migration and the longest absences of its men (Goddard 1971). Though the presence of land that will support intensive cultivation and nearness to an urban market may promote intensification, they would not necessarily do so in the absence of population pressure.

Secondary occupations and labor migration may supplement agricultural activities or they may be alternatives to further intensification. That more intensive farming on smaller holdings is a matter of expediency rather than preference is shown by the Zaria data (Fig. 19). Though heavier labor and fertilizer input have more than doubled income per acre, the disposable income per resident has declined. Where nearness to a city made modern jobs available, these may provide a better income than farming, but traditional crafts and services provide somewhat lower average remuneration (Norman 1977). Seasonal labor migration produces the lowest income. "Neither local off-farm activities nor labor migration are adequate substitutes for a substantial farm income in maintaining or raising living standards for the majority of the rural population" (Goddard et al 1975). The Hausa farmer is generally not confined to one of these options, and indeed the combination of agriculture with one or more secondary occupations may make the fullest and most profitable use of his labor time as well as cushioning him against climatic and economic fluctuations. Nevertheless, if land availability and market accessibility allow, the intensification of agriculture appears a more profitable alternative than crafts or services and than labor migration.

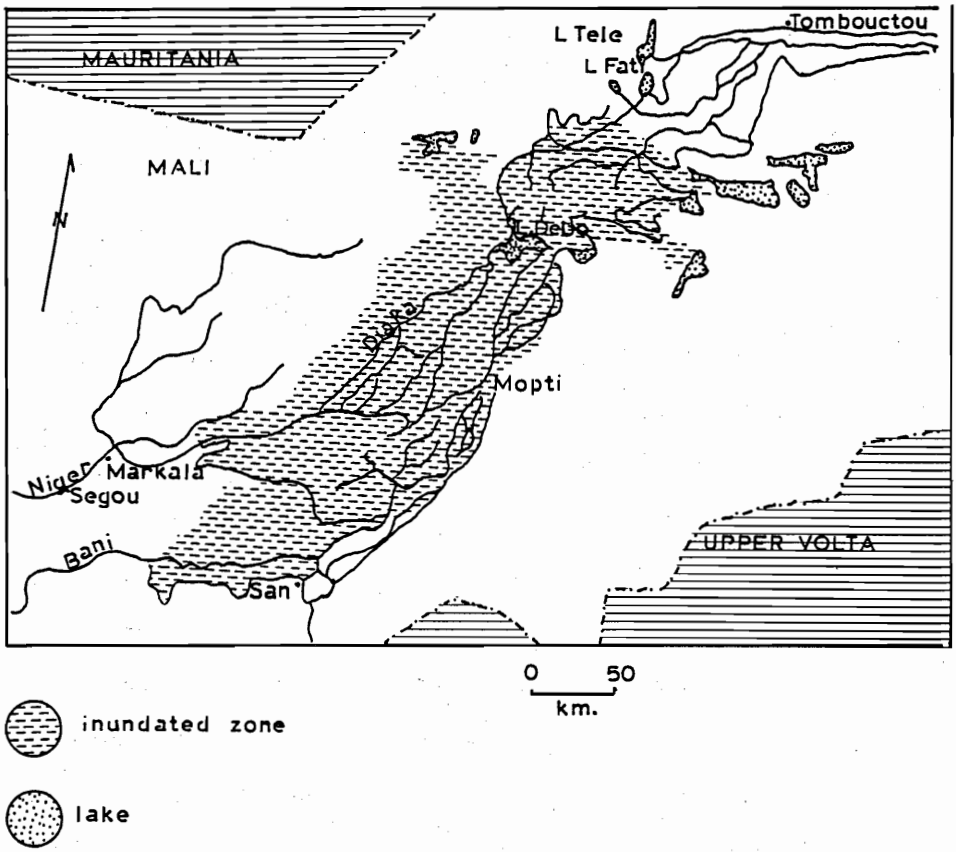
The contention that control and exploitation of others is a requisite for agricultural intensification is not borne out by the Hausa case study. Though slavery was widespread in the pre-colonial period and slave estates were controlled by an urban elite in certain areas, there is no indication that this institution was functionally related to certain farming techniques or field systems. Indeed the role of slaves was similar to that of married sons in gandu with the exception that slaves had no rights of inheritance (Hill 1977). Slaves could farm their own subsistence plots and engage in secondary occupations. The same conditions of land shortage that require increased labor inputs and lead to smaller households, fewer gandu, and more individualization of tenure would presumably have decreased the profitability of slavery for the average smallholder. If land is not in short supply, the most efficient means of production are those of bush fallowing, and these are likely to be practiced whether there is servile labor or not.

Governmental intervention to secure intensification among the Hausa is most likely to be effective in indirect ways, for example the building of a more viable infrastructure and the stimulation of market incentives for producing crops by intensive means. Agriculture experimentation and the dissemination of tested new techniques is

also the province of government. Where traditional methods no longer suffice to increase production for home consumption and for export, the government should introduce additional methods for intensification in those areas where the process is already taking place. Kano State now has the primary agricultural objective of bringing into perennial production a very extensive area within the close-settled zone by irrigation from dams on the Kano River and its tributaries. "If it works, this will extend the growing season throughout the year, double production, and develop commercial farming beyond the constraints previously imposed by the prior needs of subsistence" (Goddard et al 1975).

Interior Niger Delta of Mali. This section will discuss the ecology of rice cultivation in the interior delta of the Niger River, located in southern Mali (see map, fig. 23), concentrating on traditional agricultural methods, on the organization of production, and on the effects of colonial and post-independence development programs on cultivation. It will thus be possible to see what forms of intensification have been practiced in the past, to assess proposals by agronomists and by planners to improve cultural practices, and to examine the reasons for the success or failures of these programs.

Figure 23: Interior Delta on the Middle Niger-Mali

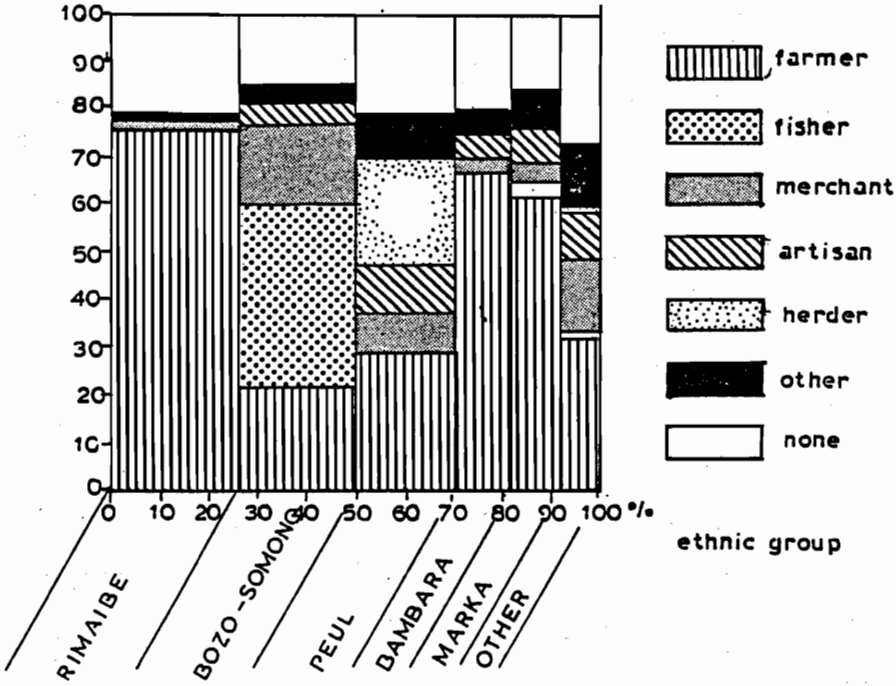


The interior Niger delta is a vast expanse of annually flooded marshes and plains, within a complex fluvial network. It is a region of great ethnic diversity, in which groups having different economic specializations have long been interdependent. The percentage distribution of principal occupations for ethnic groups is shown in Figure 24. Throughout the history of the region, conditions of trade with national states have had important effects on the character of agricultural production in the region, as well as on the density of human populations, and on settlement patterns. The interaction of ethnic groups in this region is best introduced in its historic setting.

From earliest times, immigrants to the interior delta have become assimilated, taking on the ethnic identity of groups already resident there, and so ethnic labels should be taken as cultural and occupational designations, rather than as racial ones. The autochthonous inhabitants of the delta, the Bozo, were fishermen and probably cultivators of the native small grain fonio, *Digitaria exilis*. The next to arrive on the scene were the Nono (who are presently included within the Marka), and they were the probable domesticators (Gallais 1967:80) of indigenous West African rice, *Oryza glaberrima*, some 3500 years ago.

Archaeological remains of the pre-Islamic period show possible trade contact with the Ghana kingdom (9 - 11th

Figure 24: Ethnic group by principal occupation - Inland delta - Mali



(M.I.S.E.S. 1961 b:55)

century C.E.), and subsequent growth of Diaka and of Djenne as commercial centers (Gallais 1967:82). The Islamic empire of Mali conquered the region in the first half of the 14th century, and Djenne gained importance as the intersection of trade routes from the north (carrying salt), and from the south (bringing slaves). The fall of Mali, and subsequent conquest by the Songhai empire and by Morocco did not diminis the delta's prosperity. In the period 1450 - 1650, the interior of the delta was densely populated (Es'Sadi, cited in Gallais 1967:86), and produced an abundance of rice, barley, cattle, fish, cotton, and cotton cloth (Leo Africanus, cited in Gallais 1967:85).

Two other ethnic groups began to enter the region in this period, the Peul (pastoral nomads) and the Bambara (cultivators of millet using slash-and-burn methods). These waves of immigration, which continued over three centuries, established the Peul in a complicated pattern of seasonal transhumance, while the Bambara occupied the unflooded embankments which surrounded the delta. Peul captives, the Rimaibe, formed agricultural villages near base-camps of the Peul and specialized in rice cultivation. Over time, in many parts of the delta, there grew up a mutual interdependence between herders and agriculturalists. For the region as a whole, however, political authority was fragmented.

In 1818, Chiekou-Ahmadou unified the delta under an Islamic theocracy. He tried to reduce inter-ethnic frictions by establishing permanent villages of Peul, allocating pastures, and regulating the routes to be followed by the herders in their seasonal migrations. This period of relative stability ended with the Tukolour invasions (originating in Senegal), in 1861. In the course of the incursions that followed, much of the left bank (north-west) of the Niger was laid waste, while the right bank, which received many of the refugees became much more densely settled. This difference in occupation density has persisted to the present.

With the French conquest of the delta in 1893, the left bank was administered from Djenne, while the right bank remained under indirect rule until 1902. The French emancipated the Rimaibe, who settled mostly on the left bank, occupying much of the best land for rice cultivation.

About a quarter of the population of the interior delta depends primarily on rice cultivation (M.I.S.E.S. 1961b:58) for subsistence -- these are mostly Marka and Rimaibe. Some Bambara and Bozo cultivate rice as a supplementary crop. We will see, however, that rice farming is not always a reliable subsistence base. Precipitation patterns and flood patterns vary greatly from year to year --

a field which received optimal water levels one year may be outside the survival range for rice plants the next. Even trained hydrologists have not always correctly predicted flood levels; indigenous farmers have an even greater margin of uncertainty. Like gamblers, farmers must try to hedge their bets, e.g. to plant several fields at different elevations, to sow a mixture of seed types having different water requirements. This case study will try to find out how the element of risk affects prospects for intensification.

Figure 26 shows the amount of variation from year to year in total annual precipitation. The distribution of the rainfall can be as crucial for agriculture as its quantity. Figure 25 shows a typical distribution, but inter-annual variation can be considerable. For example, Figure 25 shows that the date of first significant rainfall (i.e. 3 mm., followed by a similar rain within a week) can vary between mid-May and the beginning of July. Similarly, the date of the last significant rainfall can vary between mid-September and the end of October.

To discuss these data, it is necessary to have a rough idea of the yearly cycle of rice cultivation on the inundated plain. Figure 27 shows the seasonality of precipitation, flood levels, and the rice cultivation cycle. Rice fields

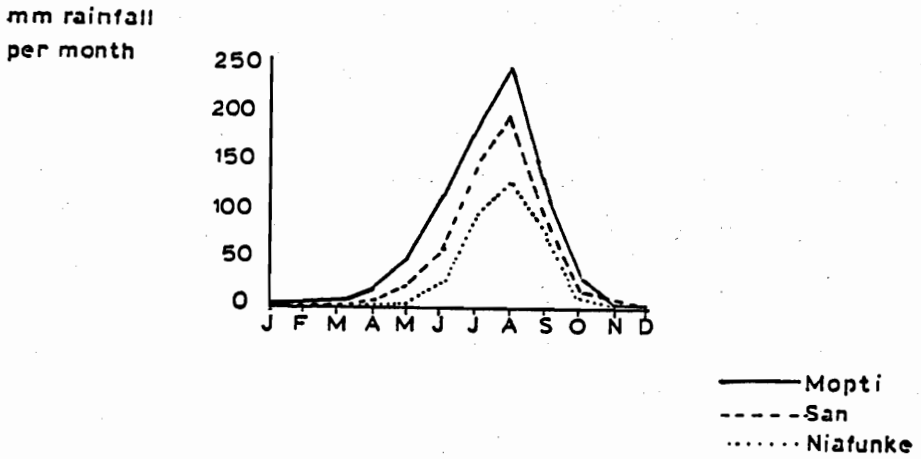
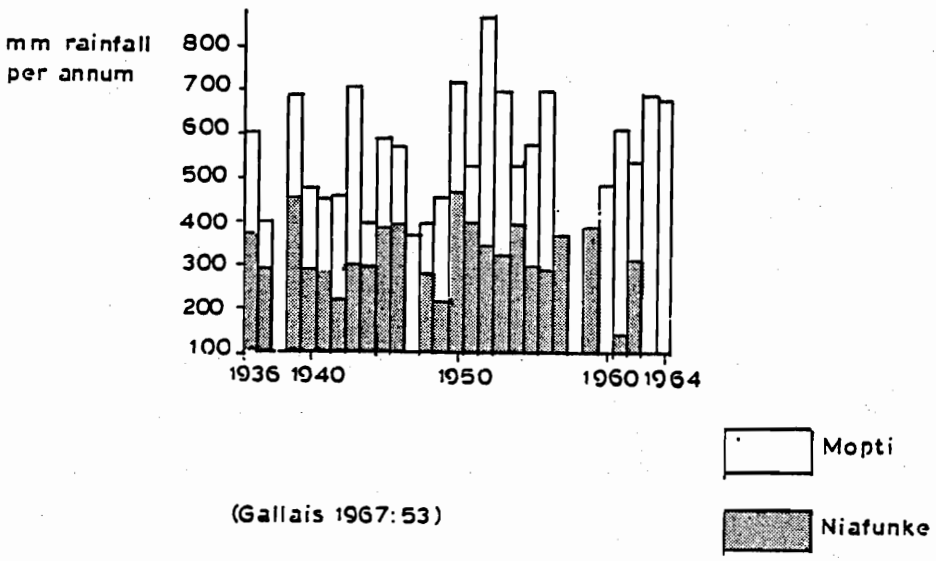


Figure 25. Monthly rainfall



(Gallais 1967:53)

Figure 26 Interannual variation in rainfall

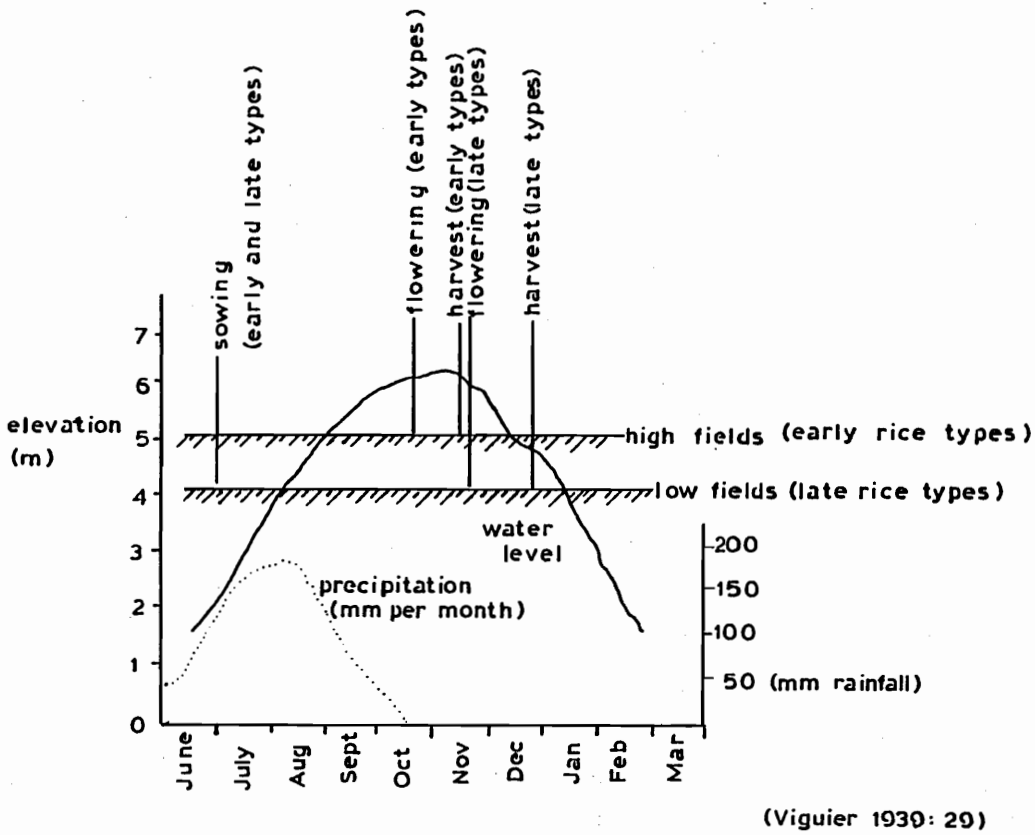


Figure 27. Flooding, precipitation, and scheduling in rice cultivation

are sowed at or near the start of the rains, in order to give the plants as much time as possible to develop before being submerged. If sowed too long before the rains, the seed will not germinate, and will be eaten by sparrows and ducks (Gallais 1967:220). However, late sowing increases the risk of plants being submerged before they are well developed; if flooded too early, the plants may be asphyxiated, and rice-eating fishes may do great damage (Viguier 1939:86). Low-lying fields are, of course, most liable to early submersion.

The date of the end of the rains can also be crucial. Figure 27 shows that, typically, rains taper off as flood levels are rising, so that high-elevation fields are submerged just before rainfall becomes inadequate for the plants. If, however, there is a gap of more than a few weeks between the end of the rains and the inundation of the fields, the young rice plants will be dessicated before the flood waters reach them. High lying fields run the greatest risk in case of an early termination of rains, or late onset of flooding.

The waters of the Niger and of the Bani are a source of soil nutrients, as well as a supplement to the insufficient rainfall of the interior delta. Measured at Segou, the waters carried concentrations of: 0.1 mg/l. P_2O_5, 0.5 mg/l. K_2O, and 0.2 mg/l. CaO (Angladette 1966:220). While these

concentrations are far lower than, for example, the Mekong or other rivers in southeast Asia, nutrient levels are not negligible.

The two rivers which water the delta are the Bani (originating in the north-west Ivory Coast with a catchment area of 101,600 km^2, Gallais 1967:56), and the Niger (originating in the Guinea highlands with a total catchment area of 120,000 km^2). On the average, the inundated area of the delta is about 19,000 km^2, but this area can vary by about 3,000 km^2 from year to year (Gallais 1967:84 ff). The timing of floods also varies from year to year. Three flooding situations are especially hazardous for agriculture:

1. Early rapid inundation -- most dangerous on the south-west floodplains. The young plants are drowned, or eaten by fishes.

2. Unusually low water levels -- plants in higher lying fields will be dessicated.

3. Early recession of the waters -- if fields are left dry while rice grains are still forming, yields will be low, and there will be greater loss due to grain breakage during hulling (Gallais 1967:220).

Rice cultivators have several possible ways to minimize crop loss: they can choose varieties that are resistant to asphyxiation and to herbivores, they can construct irrigation canals and protective dykes, and they can plant several fields at different elevations. Figure 27 shows the timing of flooding for high and for low-lying fields.

The upper limit of elevation for rice fields will be imposed by two necessities:

1. The field must be flooded within two weeks after the last useful rain (i.e. more than 3 mm.).

2. The field must be flooded for at least two months.

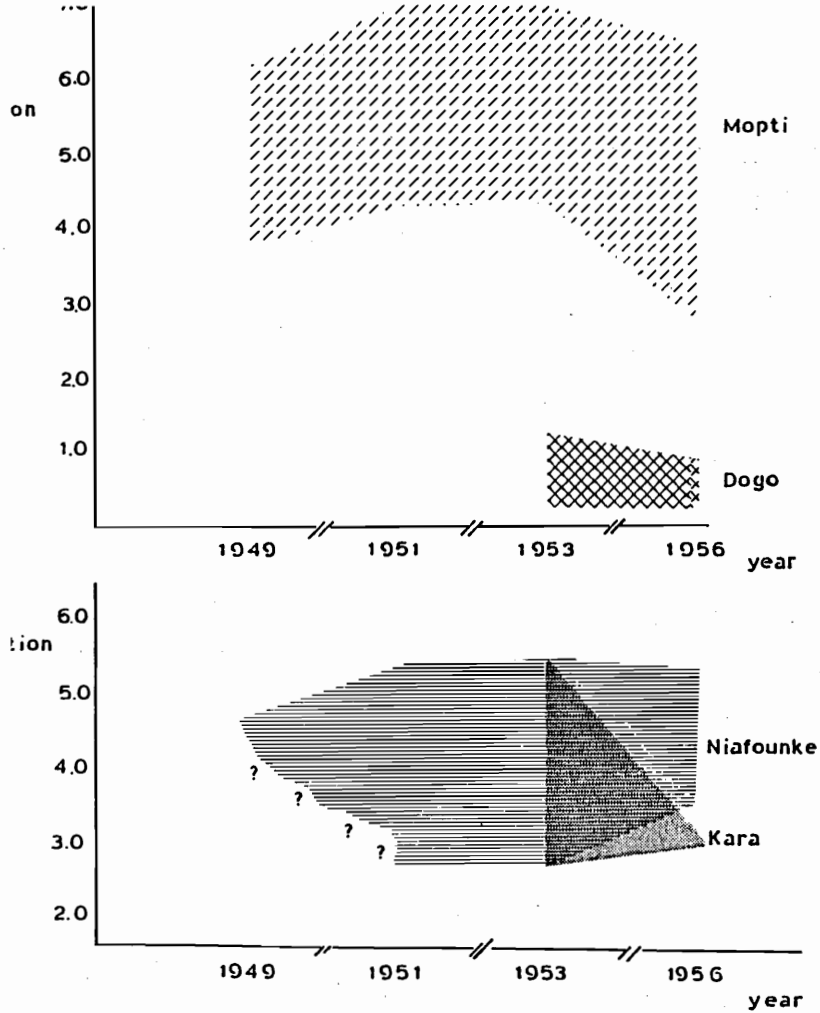
The lower limit of elevation in which rice can be expected to produce will be governed by two factors:

1. The maximum depth of inundation must not exceed 3 m. (for Oryza glaberrima) or plants will be asphyxiated.

2. Inundation must not start until after (approximately) 200 mm. of rainfall, in order that root systems of rice be established, and in order that the plants be resistant to rice-eating fishes (Gallais 1967:223).

Figure 28 shows the upper and lower "safe" elevations for rice fields, in four parts of the delta. Although these data are not complete, they give an idea of the extent of interannual variation. Fields which lay within the safe zone during one year, may well be outside it in the next. Figure 29 shows the location of rice fields for a single Rimaibe village near the Diaka during periods of weak flooding (1943 - 1949), higher flood levels (1950 - 1955), and resumed weak flooding (1956) (Gallais 1967:234). Each time the flood cycle changed, farmers had to obtain and to clear fields at a different elevation.

Two sorts of perspectives are possible in discussing soils and their agricultural potential: the viewpoint of the



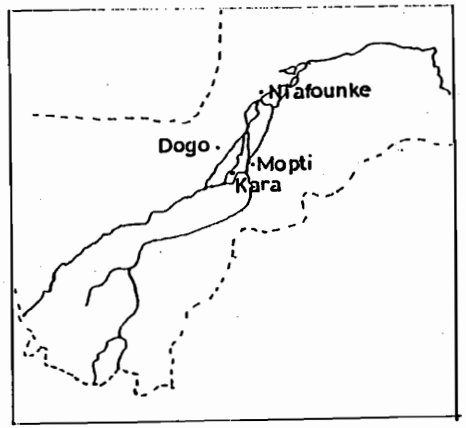
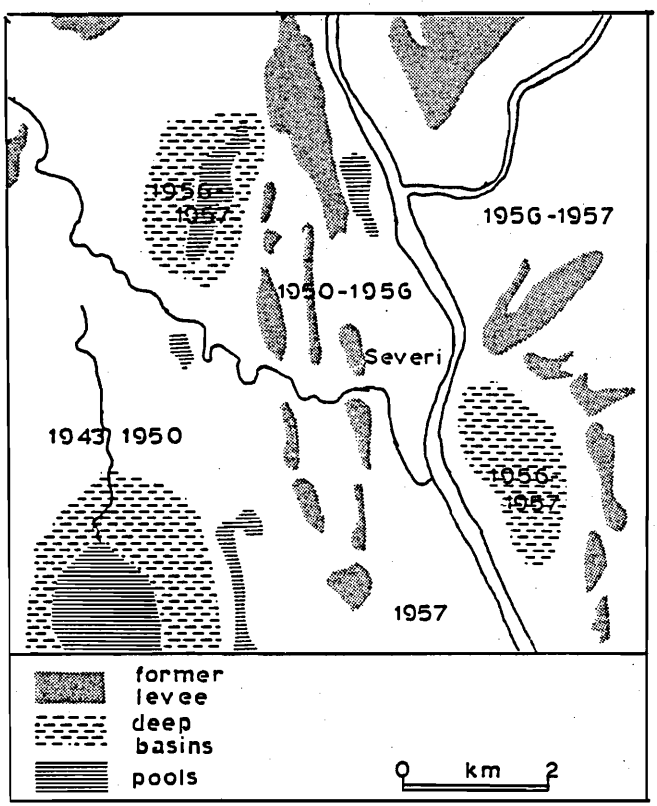


Figure 28. Interannual variation in "safe" elevations for rice fields in four locations (Gallais 1967: 222f)

Figure 29: Location of inundated rice fields
1943-1957 Severi (Mali)



1943-1950	weak flooding-cultivation of low lying land
1950 1956	strong flooding- cultivation of lands between former levees and on present levees
1956 1957	weak flooding

western agronomist, or that of the indigenous cultivator. The agronomist finds from physical analysis that, overall, soils of the delta are compact, and predominantly composed of clay and silt (Viguier 1939:15). Chemical analysis (Viguier 1939:17) shows them to be rich in humus and nitrogen, poor in lime, and slightly acid (Gallais 1967: 200). Experiments with fertilizer response of Oryza sativa showed optima in treatments with: a) ammonium sulfate (75 kg/ha) + rice bran (1,500 kg/ha), and b) NPK + rice straw, plowed under (Angladette 1966:349, 352).

For mechanized agriculture, the greatest problem with the delta soils is their poor structure - many soils turn into fluid mud when wet (Guillaume 1960:285), and become cementlike when dry. Thus, tractor plowing during the dry season is difficult, and does not improve structure. Mechanical harvesting is difficult due to poor drainage. Cotton, a crop which demands well drained, aerated soils, grows only with difficulty in most regions of the delta.

The Rimaibe recognize four types of soils:

Leydi diarendi -- a sandy soil found in fluvial deposits and around ancient dunes. It is most easily worked just after the floods have receded.

Leydi daneri (white earth) -- richer in silt and in organic matter than leydi diarendi. It is found on contemporary or on ancient levees. Once dry, the soil is very hard to work.

> Leydi boderi (red earth) -- clayey soil, which develops deep cracks when dry. When wet, it adheres to the hoe and cannot be worked.
>
> Leydi baleri (black earth) -- soils with a high humus content, overlying gley soils (Gallais 1967:200).

Cultivators take the differential friability of soil types into account when planning fields, using partly diarendi and white earth types (which must be worked before fully dried), and partly red earth and black earth types (which are best worked after drying).

Vegetation in the interior delta has been strongly influenced by human habitation. Pastoralists have repeatedly burned vegetation of the ancient floodplains, which now show mainly pyrophilic species. In the first decades of this century, woodcutting for steamships on the Niger river stripped the levees and ancient dunes of their wood cover; now, wood is used mostly for fish smoking.

On the floodplain, vegetation types depend on the duration of flooding: areas submerged less than three months have dense growth of Vetiveria nigritana; areas where flooding lasts 3 to 6 months have dense, pure stands of Oryza perennia (a close relative of cultivated rice, and a particularly pernicious weed); and areas submerged for more than 6 months of the year have an association called bourgou (extremely dense growth of Echinochloa pyrimidalis, E. stagnina, and

Panicum stagnium, important as dry-season pastureland). Burning of floodplain grasses, unlike the burning of higher-lying ground, is probably beneficial. It rids the land of dead straw, and encourages quick regrowth. Grazing on these lands also encourages the growth of new shoots. Vegetation types act as indicators of soil fertility, for native cultivators. Stands of Oryza perennis (they say) denote land that is fertile for domestic rice cultivation. However, the appearance of O. breviligulata is a sign of soil exhaustion, and cultivated fields infested with it will be put to fallow.

Oryza glaberrima Steud. is the species of rice traditionally cultivated in the interior delta. Although O. sativa was introduced in 1914, it is still of secondary importance. Only small differences in glume pubescence and in ligule size separate the two species (Purseglove 1972:161). Botanists consider that both O. sativa and O. glaberrima are descended from Oryza perennis, which persists as a weed on rice fields. Although agronomists consider O. perennis harmful, and recommend that farmers extirpate it, the seed can be harvested (although with difficulty, since the rachis, or stem bearing the seeds, shatters easily), and contribute significantly to the diet when other crops fail (Viguier 1939:44).

Many agronomists (e. g. Grist 1975:190; Chabrolin 1977:18) consider O. glaberrima to be inferior to O. sativa. Its maturation period is long (150 - 180 days for most commonly planted varieties, see Fig. 30); its yields are relatively low (approximately 800 - 1100 kg/ha; Bourke 1965: 46); it is not responsive to nitrogen fertilizer; its straw is weak; the rachis tends to shatter at harvest; and, finally, the pigmented pericarp is difficult to remove by milling so the cooked rice has a distinctive red color. However, the varieties of O. glaberrima which are cultivated are the result of long selection. Since rice is self-pollinating, it is relatively easy for cultivators to develop strains suited to local conditions.

> "Much red rice (O. glaberrima) is grown under conditions where chance plays a larger part than is usual in agricultural practice in determining the size of the harvest...In bad years, which may mean that the floods are either too large or too small, some areas may yield no harvest at all. Nevertheless, red rice can withstand much rough treatment and still give a reasonable yield. In a favorable year, the farmer is well repaid for his work, and even when yields are low it should be remembered that under the same conditions the less vigorous white rice might have been a complete failure" (Bourke 1965:44-45).

The varieties traditionally grown in the interior delta are floating rices (roots remain in the soil, heads "float" on the surface of the water): they can grow extremely fast -- up to 10 cm/day, to keep pace with rising flood waters

Indigenous name	Linnean subspecies	variety	subvariety	vegetative period (days)	field level	period able to withstand complete submersion	adherence of grains to rachis	productivity	consumer preferences
Early rices									
temo	vera	breviglumis	fluitans	135	- -	not resistant	moderately good	average	not well liked
kamanko	vera	breviglumis	fluitans	135	high	- -	good	average	
kesirime	vera	longiglumis	fluitans	135	high/low	not resistant	good	average	well liked
tikirouel	confusa	breviglumis	fluitans	135	- -	not resistant	good	average	not well liked
Late rices									
porgo	vera	breviglumis	fluitans	180	low	2 - 4 days	good	excellent	
koussadiamou	vera	breviglumis	fluitans	180	low	3 - 4 days	bad	average	grains prone to break
karosapia	vera	breviglumis	fluitans	170	low	3 - 4 days	- -	excellent	less well liked than simo
tomo	vera	breviglumis	fluitans	150	low	not resistant	moderately good	good	less well liked than simo
simo-raneo	confusa	breviglumis	fluitans	170	low	2 - 3 days	moderately good	excellent	very well liked - grains not prone to break
simo-baledio	confusa	breviglumis	fluitans	165-168	low	2 - 3 days	moderately good	excellent	very well liked
simo-ouadeo	confusa	breviglumis	fluitans	180	low	2 - 3 days	moderately good	excellent	less well liked than simo-baledio
simo-bourou	confusa	breviglumis	fluitans	170	low	3 - 4 days	- -	excellent	

Viguier (1939:41-83)

Figure 30. Agronomic characteristics of cultivated varieties of Oryza glaberrima grown in the inland delta - Mali.

(Bourke 1965:46). Botanists (Viguier 1939:46 ff) recognize two series for O. glaberrima, each having two varieties, and each variety having both floating and non-floating sub-varieties, i.e. eight categories in all. Indigenous farmers recognize 41 varieties in all, and many of the varieties have names in several languages. Farmers of all ethnic groups divide cultivated varieties into two broad categories: early rices (with a maturation period of 115 - 140 days), and late rices (with maturation in 150 - 180 days). The early rices, which give relatively low yields, are planted on a small scale, for local consumption. They are important because they mature during the period when the stores of the previous year are almost exhausted, while the main harvest is still unripe. (Approximate scheduling for early and late types is shown in Fig. 27).

Fig. 30 gives some of the important physiological characteristics of 12 varieties commonly grown in the interior delta. The optimal elevation for fields of early and late types is governed by two considerations:

1. Early types are not resistant to submersion and so are grown on higher ground.

2. Late types require a longer period of inundation, and so are sowed on lower ground.

Adherence of the grain to the rachis influences the ease of harvest; where the grain scatters, cultivators must choose between harvesting slightly before maturity, and risking losses when the grain is gathered. Taste and breakage of grains in decortication govern the marketability of the final product.

Discussion of the agricultural cycle will be based on a detailed account of a Rimaibe household in the village of Daga, to the south of Tenekou (Gallais 1967:200 - 228), as well as on more general descriptions (Viguier 1939, Bourke 1965). Figure 31 shows the seasonal cycle of agricultural work.

The decision of where to establish rice fields should ideally be made almost a year in advance of planting, since clearing methods depend on flooding to kill vegetation. Generally, if a year's harvest has been satisfactory, the fields will be reused the next year thus avoiding the labor of clearing new fields.

If the farmer has decided to clear new fields, he has the choice of three methods. The most effective is bala-sa, which requires burning a field before the start of the rains, and letting the empty field be flooded. In balagou clearing, the cultivator cuts the vegetation in August or September -- before the floods, in order that weeds be asphyxiated. When the floods recede, the farmer pulls any surviving

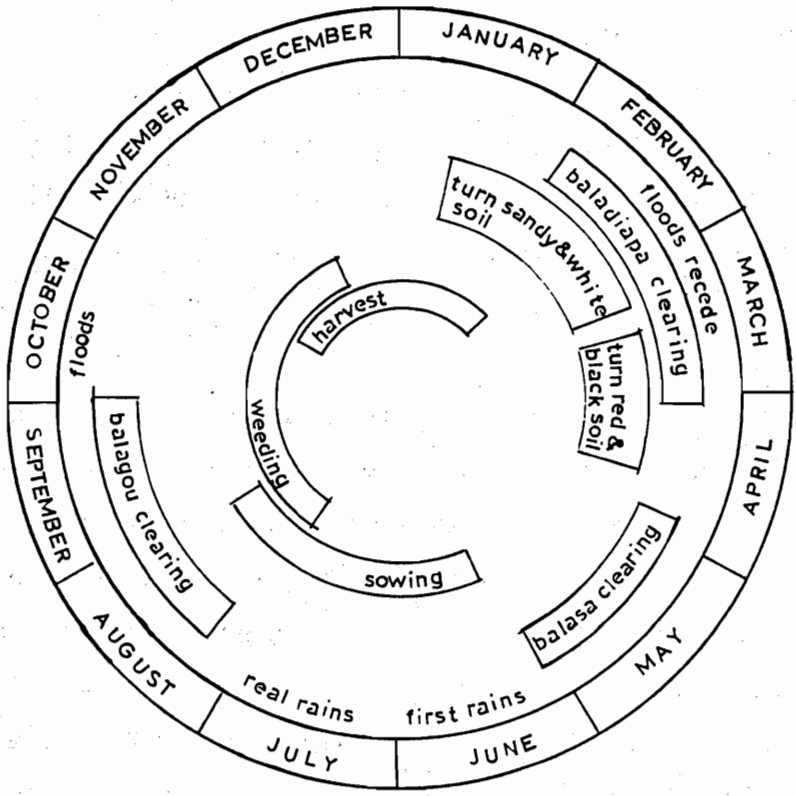


Figure 31. Agricultural calender for Rimaibe rice cultivation

rhizomes, and burns the dead stems. Ideally, then, a farmer clears fields more than a year before they are to be planted. If the farmer was unable to clear before the floods, the method used is called baladiapa, and begins when the waters start to recede. He cuts the stems of vegetation, letting the cut material float on the water's surface, thus killing most above-ground growth. This method, however, does not kill weed rhizomes, which must be extirpated after the waters have receded.

Soils differ in the ease with which they can be worked. Thus, leydi diarendi (sandy soil) and leydi daneri (white soil) will be worked while moist; while leydi boderi (red, clayey soil) and leydi baleri (black earth) will not be worked until they are dry. It should be noted that the first two types of soil are much easier to work -- they require 30 - 35 man-days/ha -- while red and black soils require 60 - 80 man-days/ha (Gallais 1967:206). The work is done with a daba, a heavy pointed hoe. Viguier (1939) noted differences between ethnic groups in the care with which initial ground working was carried out. Marka and Bambara (ethnic groups predominating on the relatively densely settled right bank of the Niger) used more care in cleaning clods of rhizomes than did Rimaibe (who are concentrated in the sparsely settled left bank). After being turned, the soil is left to dry until the fields are sown. Drying in the sun helps

kill any surviving rhimzomes (Bourke 1965:44), and the early rains help somewhat to break up the clods.

Faced with several unknowns, the farmer generally chooses to plant early at the start of the rains in the hope that the rice plants will be sufficiently well developed by the start of inundation to withstand rice-eating fish, and to avoid asphyxiation during total submersion. Experiments have shown (Chabrolin 1977:16) that plants require 30 - 45 days to reach this stage. If, as sometimes happens, the first rains are followed by a long, rainless interval, and if the young plants die during that interval, the farmer replants.

In sowing, the seed is broadcast, generally after being soaked in water for 24 hours (Bourke 1965:44). The clods are broken with a hoe to cover the seed, and to protect it from rice-eating birds: Anas quer-quedula and Plectopterus gambiensis (both ducks) and sparrows (Viguier 1939:96). The dates for planting early and late varieties of rice are the same. In areas where the young plants are endangered by rice-eating fishes, the cultivator will often seed more densely. Thus, within the interior delta, seeding densities range from 60 - 125 kg/ha; while, in the upper valley of the Niger (where rice-eating fish are not a danger), seeding densities seldom exceed 30 kg/ha (Viguier 1939:85). For the same reason, low-lying fields (usually planted to late varieties

will be more densely seeded than will higher ones. To reduce the risk of total crop loss due to adverse conditions, the farmer often sows each field with a mixture of seeds having different water requirements.

In general, fields are weeded twice. High fields are weeded once when the rice is approximately 30 cm. high, and again after flooding (usually in September). Low-lying fields are weeded once at the beginning of the floods, and again in October. The first weeding requires considerable skill, since two of the most common weeds, O. perennis and Saccolepis interrupta, are virtually indistinguishable (when young) from young rice plants. There is, however, great variability in the intensity of care given to rice fields. Sometimes, the first weeding is accompanied by hoeing (Gallais 1967:209); sometimes the uprooted weeds are carefully piled on the boundaries of the field, creating, in time, dykes some 40 cm. high (Viguier 1939:87). Small fields individually owned (especially owned by women) may be weeded as many as five or six times.

Harvesting begins in October (for early varieties), and continues until January (for late varieties). In most years, the fields are still flooded when the grain matures, and so the harvest must sometimes be carried out from canoes. The panicles are cut with a sickle, bound in small bunches,

and placed on racks to dry. In years when the floods have already receded at harvest, the rice will be cut about 20 - 30 cm. from the ground, and bound into sheaves.

The timing of the harvest is crucial, since the rachis becomes brittle at maturity, and scatters the seed. The situation is made more difficult by the fact that O. glaberrima is photoperiodic (that is, its flowering and maturity are triggered by a specific day length, no matter what the total amount of time since germination). Thus, some localities (Gallais 1967:210) harvest each cultivated variety at a specific date on the solar calendar. Farmers have two ways to cope with the scheduling requirements of harvest: they plant several varieties of rice with different maturation dates, and they also exchange labor among themselves (Gallais 1967:210). When the harvest has been gathered and the straw in the fields is dry, the fields are burned, and the cycle begins again.

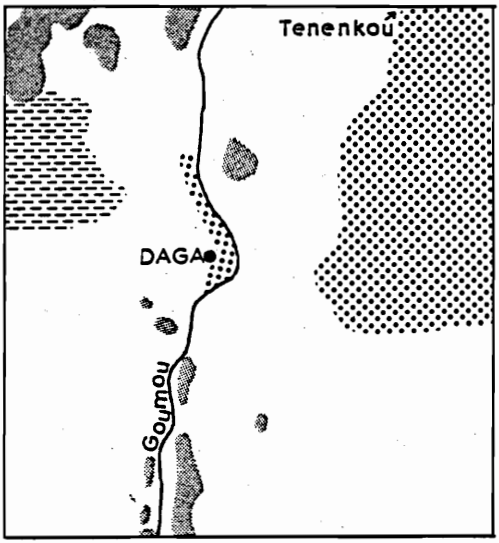
The cut sheaves are often left in the field for several days, then gathered and placed on drying racks, covered with straw to protect the rice from birds, and surrounded by thorny branches, to protect against other herbivores. The grain is threshed when thoroughly dry, using a flail, and the rough rice, or paddy, is bagged or put into granaries.

Almost no information is available on garden cropping methods. The main crops are corn, karite, peanuts, cotton, tobacco, and fruits and vegetables (cultivated primarily by women) (M.I.S.E.S. 1961a:49).

Within partial irrigation projects animal traction is used for plowing, just after the first rains, and then for harrowing. Seed is broadcast and the field is harrowed again. After the seedlings are 45 days old, gates in the dyke are opened, and the field is flooded (Steedman et al 1976:232).

Within a total irrigation project tenant farmers pre-irrigate fields (according to Bourke 1965:49), and then use animal traction to plow to a depth of 4 - 6 inches. Seed is broadcast by hand between 15 May and 30 July. After being sown, the field is immediately flooded and drained. After the plants are 2 - 4 inches tall, the field is flooded again, and water levels are maintained until the plants' maturity.

Rimaibe villages where rice is cultivated are usually located on waterways, and their rice fields also border the streambanks (Fig. 32 shows the location of Daga, with its fields). Members of an extended family participate in two types of agricultural production: collectively during five days of the week they cultivate one or more foroba (communal) fields; individually during the remaining days they cultivate



(Gallais 1967: 201)

rice fields 1952

pre 1952 rice fields

former dunes

0 km 2

Figure 32. Location of Daga with respect to present and former rice fields

kourga (individual fields, whose produce is mostly destined for the market.

For our sample family (which has 11 members), the cultivated area is divided as follows: 5.52 ha. in communal fields 1.81 ha. in individual fields, and 0.01 ha. in garden plots (galle, cultivated by two women, in which was grown corn and a type of millet used for dyeing). In all, the family works 7.33 ha., or 0.66 ha/person (Gallais 1967:204). For rice-cultivating inhabitants in the traditional zone of the central delta as a whole, the average cultivated area is 0.649 ha/person, of which 0.61 ha. is planted with rice (M.I.S.E.S. 1960:36).

However, the importance of individual cultivations may be greater than their small size would imply, in that they seem to be worked more intensively than are communal fields. For example, Viguier (1939:61, see Fig. 33) estimated that rice yields from small garden plots might be four times as high as average yields from large plots. Speaking of Mali in general, Jones (1976:281) noted that individually worked fields were often manured with households' wastes, and often irrigated from wells (see also Ernst 1976:104). Of an area-wide sample of farmers in the interior delta, M.I.S.E.S. (1961a:48) found that agricultural products other than rice and millet contributed, on the average, 11.7 per

cent of income from agriculture for families owning a plow (many of whom live in the main rice cultivation areas), and 23 per cent of agricultural income for families not owning a plow (many of whom live on the margins of rice cultivation areas). These figures do not, of course, include income from sales of grain from individual crops, and so it is probable that they understate the production of individual plots.

Figure 33 shows three sorts of production figures for rice: estimates of the ranges of yields, planned targets, and actual average yields. The figures come from several different sources, and seem, at first glance, to show a good deal of variation. Actual averages for yields of O. glaberrima using traditional methods seem to fall at the low end of the estimates of Viguier and of Bourke. Production targets in the Five Year Plan 1961 - 66 seem to have been unrealistic, when compared with actual production at the end of the plan. Plow-owning farmers obtained slightly higher yields (116%) than farmers without plows, while large-scale irrigation projects (growing O. sativa) showed yields that were considerably higher than for traditional agriculture.

In assessing proposals to improve the lot of traditional cultivators, dietary intake studies have an advantage over

species	yield (kg/ha)	area	notes	
Oryza glaberrima (estimates)	700-800	Niger River	"satisfactory yield"	(a)
	1500	Niger River	"excellent yield"	(a)
	3000	Niger River	possible in intensively cultivated gardens, with traditional techniques	(a)
	790-1120	west Africa	range of yields for traditional techniques	(b)
	900-1460	west Africa	approximate range of yields	(c)
unspecified	1025	inland delta	farmers in the traditional zone using a plow - 1958	(d)
	885	inland delta	farmers in the traditional zone not using a plow - 1958	(d)
	830	Mali	(not including Office du Niger) - 1959	(e)
	800	Mali	lands without water control - 1966	(f)
	887	Mali	lands under partial water control - 1966	(f)
	1800	Mali	"reasonable" yield on lands under partial water control	(f)
	1400	Mali	"possible" yield for polder, using animal traction, and improved seed	(g)
	1900	Mali	above + seeding in lines, cultivator for weeding, chemical fertilizer	(g)
Oryza glaberrima	2000	Office du Niger	fields managed by Office du Niger, not using transplantation (1930s)	(a)
	3000	Societe Civile de Dire	using transplantation	(a)
	630	Daga	Rimaibe cultivator using traditional methods	(h)
Oryza sativa	1709	Office du Niger	(Niono-Molodo) full irrigation 1958	(d)
	1426	Office du Niger	(Mokry) full irrigation 1958	(d)

(a) Viguier (1939:61)
(b) Bourke (1965:45)
(c) M.I.S.E.S. (1960:37)
(d) M.I.S.E.S. (1960:39)
(e) Jones (1976:274)
(f) Jones (1976:308)
(g) Steedman et. al. (1976:232)
(h) Gallais (1967:216)

Figure 33. Yields for Oryza glaberrima and O. sativa.

yield figures, in that they come closer to examining the well-being of people in different situations. Extensive surveys, carried out in 1958, tried to assess the effect of the introduction of ox-drawn plows, and the effect of irrigation agriculture in the Office du Niger, on the daily nutritional intake of people participating in the programs. Some of the results form Figure 34.

Overall, the investigators concluded (M.I.S.E.S. 1961b: 19) that they had no evidence for grave deficiencies, except for a relative scarcity of vitamins A and C. They found seasonal variation in the composition of food intake, with millet and sorghum contributing a greater part of total calories in the rainy season than in the dry season (when rice contributed relatively more). Seasonal variation in total calories was relatively slight (M.I.S.E.S. 1961b:17). Within the traditional zone, farmers owning a plow had higher daily caloric consumption (3,329 compared with 2,204), and a higher level of protein intake (93.8 g./day compared to 67.5 g./day) than did farmers without a plow. Comparing the Office du Niger with the traditional zone as a whole, settlers in the Office du Niger had only very slightly higher consumption levels. Overall, however, the investigators felt that persons in the traditional zone had a more varied diet, and a higher intake of high-quality protein from animal sources.

	Rice cultivators (trad. zone)	Traditional zone (total)	Office du Niger
Calories	2,370	2,315	2,370
Protein (g)	70.8	70.5	70.7
% animal protein	28.7%	25.0%	15.5%
% of calories in protein	11.9%	12.1%	11.9%
Rice intake (g)	478	378	340
Millet and sorghum (g)	82	173	268
Meat (g)	14	14	15
Milk (g)	46	40	
Fresh fish (g)	57	49	11
Dried fish (g)	36	16	14

M.I.S.E.S. (1961b:17)

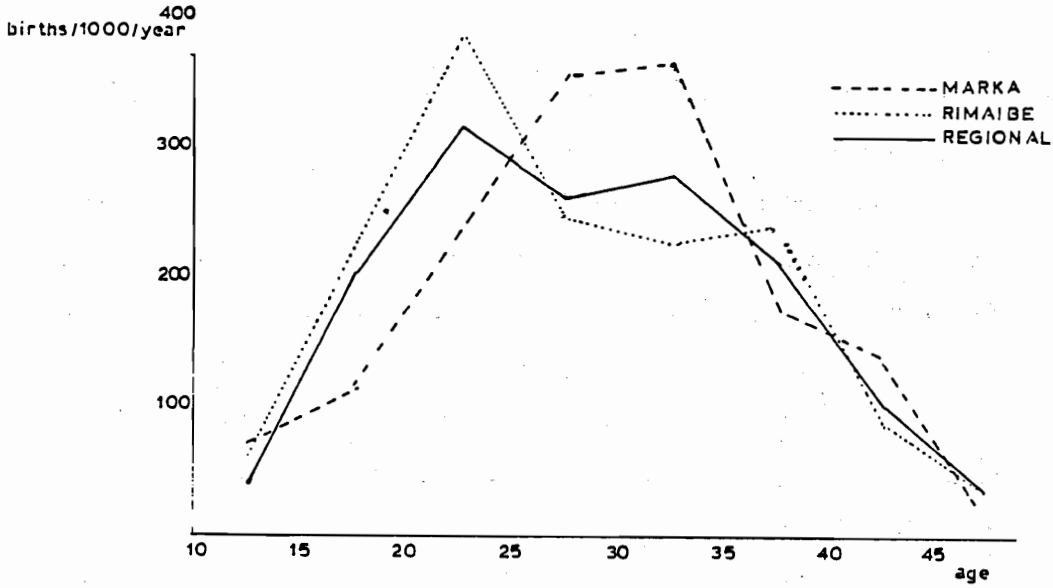
Figure 34. Daily per capita intake for the traditional zone of the interior delta (Mali) and for the Office du Niger.

In the Rimaibe household described by Gallais (1967), women participated relatively little in the cultivation of the communal fields, helping only with the weeding. Most of their time was taken up with processing the rice after harvest, with small scale vending, with crafts production, with food preparation and with gardening. The household described had a relatively short supply of women. Further ethnographic work in the delta is necessary to permit any generalizations about the actual extent of womens' participation in agriculture.

The labor requirements of the main agricultural tasks were estimated as follows: turning the soil (60 - 80 man-days/ha for red and black soils; 30 - 35 man-days/ha for sandy and white soils), weeding and hoeing (7 - 10 man-days/ha). Figures are not available for time spent in harvesting, but all together each hectare required 76 man-days for cultivation (not including the time necessary for sowing, some 14 man-days/ha additional) (Gallais 1967:217).

Crude birth rates for the Marka (56/1,000, M.I.S.E.S. 1961:II:151) and for the Rimaibe (54/1,000, ibid.) fall at the midpoint of the CBRs reported for ethnic groups of the interior delta. However, examination of Figure 35 (from

Figure 35: Age specific fertility interior Niger delta



M.I.S.E.S. 1961:II:132) shows that age-specific fertility for Marka and Rimaibe women was considerably higher than for the region as a whole. Graphs of total completed fertility (ibid.) show that average numbers of live births are considerably higher for Marka women than for Rimaibe women. In regional terms, average total live births (women 45 - 54) is considerably higher on the right bank (6.37) than on the left (4.84, op. cit:129).

Crude death rates are considerably higher for Marka (55/1,000, M.I.S.E.S. 1961:II:153) than for Rimaibe (33/1,000, ibid.), compared with 41.5/1,000 for the region as a whole, and 26/1,000 for the Office du Niger. These figures, however, were collected just after epidemics of smallpox and of measles; Gallais (1967:167) felt that 33/1,000 was a more reasonable estimate of CDR for the delta as a whole. Child mortality was extremely high for the region as a whole; less than half of live-born children survived to age five (M.I.S.E.S. 1961:II:153). For infant mortality, communities which were predominantly Marka had a far higher rate (311/1,000) than did communities with a majority of Rimaibe settlers (244/1,000, M.I.S.E.S. 1961: II:156).

Although little information is available on the health status of the region, it is possible to make some general

comments. Respiratory infections (during the rainy and cold seasons), malaria, schistosomiasis (haematobium type, diagnosed in one-half of school children observed), and leprosy were some of the widespread problems. The Bani flood plain was an endemic focus of trypanasomiasis and onchocerciasis. Smallpox and measles epidemics claimed many lives as late as 1956 - 57, being most destructive on the right bank of the Niger (Gallais 1967:168).

The demographic inquiry calculated a natural rate of increase for the region as a whole of 13/1,000. In the time since the inquiry, however, it is possible that the NRI may have risen: an agricultural study (1970-71 cited in Diawara and Traore 1975:19) showed that the rural population in the administrative region of Mopti, which includes the interior delta, increased by 19.8 per cent between 1964 and 1970. We will see, however, that in-migration to the region is an alternative explanation for the rise in the rate of population increase.

Data on temporary and permanent migration are more difficult to collect than data on natality and mortality. Ideally, a study of migration would be able to trace each move of every person born within the study area, but in practice, data on long-distance moves and permanent emigrations are difficult to recover. Thus, the M.I.S.E.S. study did not include persons absent more than five years.

The pattern of immigration to rural communities in the study region (M.I.S.E.S. 1961:I:15) showed a much larger proportion of women immigrants than of men, with the largest group of female immigrants at age 20 - 30, and a steady decline after that age. It is reasonable to infer that women migrate mostly at marriage, often returning to their birthplace if widowed or divorced.

In contrast, data on temporary absentees showed that, for the whole delta, men were more likely to emigrate than women (65.6% of absentees were men). Of male absentees, 63% were outside the interior delta; the corresponding figure for women was 52%. Figure 36 shows the age-sex distribution for Marka and Rimaibe absentees. It is apparent that men emigrate more often than women, and that the bulk of migrants are of working age. It is important to try to assess the effects of emigration on the agricultural work force.

For the nation as a whole, the proportion of agricultural population (those who list agriculture as a part-time or full-time occupation) to the total rural population showed little change between 1964 and 1970 - 71, and 90 per cent of the total population was rural in 1970 - 71 (Diawara and Traore 1975:46). However, age-specific sex ratios for the agricultural population changed dramatically in that

Age	Rimaibe		Marka	
	male	female	male	female
0-9	17.5	27.4	8.6	20.4
10-19	24.3	25.3	24.4	27.8
20-29	25.3	27.0	28.9	21.3
30-39	17.5	11.4	25.5	21.3
40-49	9.8	3.9	5.4	9.3
50-59	3.4	3.6	4.5	
60-69	1.6	0.1	2.6	
Totals	2490	1405	1330	540
% of total	(9%)	(5%)	(11%)	(4%)

(male and female population by ethnic group)

M.I.S.E.S.(1961:II:115)

M.I.S.E.S.(1961:II:23)

Figure 36. Age distribution of absentees (1957-1958) by sex and ethnic group (%).

period. Figure 37 shows that in 1964, for ages under 40, the sex ratio for agricultural workers was near 100. Starting in 1966, however, the sex ratio for workers between 21 and 40 (i.e. those most able to do heavy manual labor) plummeted, and the pronounced deficiency of men in these age groups continued through 1971. In 1971 - 72, the interior delta and the Office du Niger were both classified as regions where shortage of agricultural workers (rather than shortage of land) was a limiting factor for agriculture (Steedman et al 1976:20).

Although age-sex data by ethnic group are not available for the interior delta, the data were tabulated (M.I.S.E.S. 1961:II:37) for the de facto rural populations of the northern and southern regions of the delta, and these pyramids are shown in Figure 38. The shape of the pyramids, in general, shows the wide base and narrow apex typical of regions with rapidly growing populations. Several peculiarities can be attributed to difficulties in ascertaining ages of the persons censused. The most important observation for these pyramids, however, is their asymmetry -- the deficiency in male cohorts, starting with the 15 - 19 age group, due to the migration patterns discussed above.

In a country where almost all farms are owned and operated by a family unit, the demographic structure of

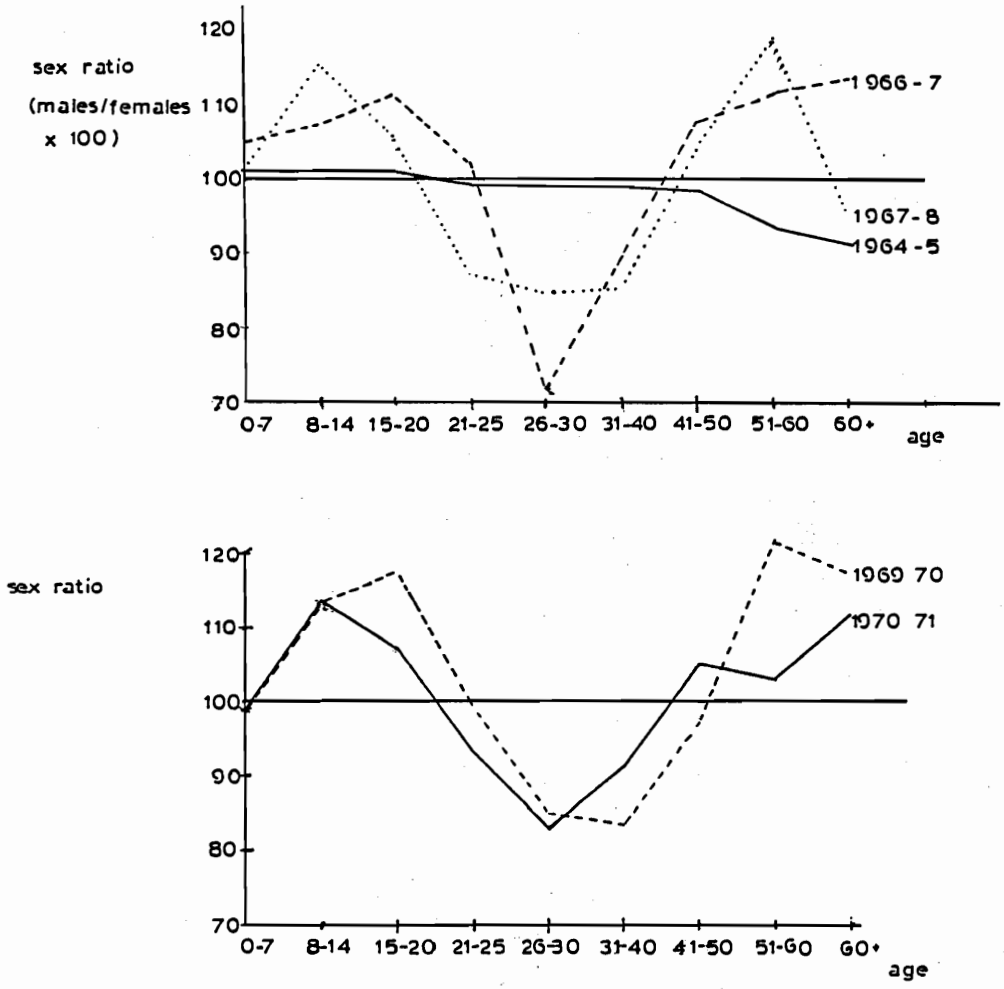


Figure 37. Change through time in age specific sex ratio of agricultural population

(Diawara and Traore 1975:49)

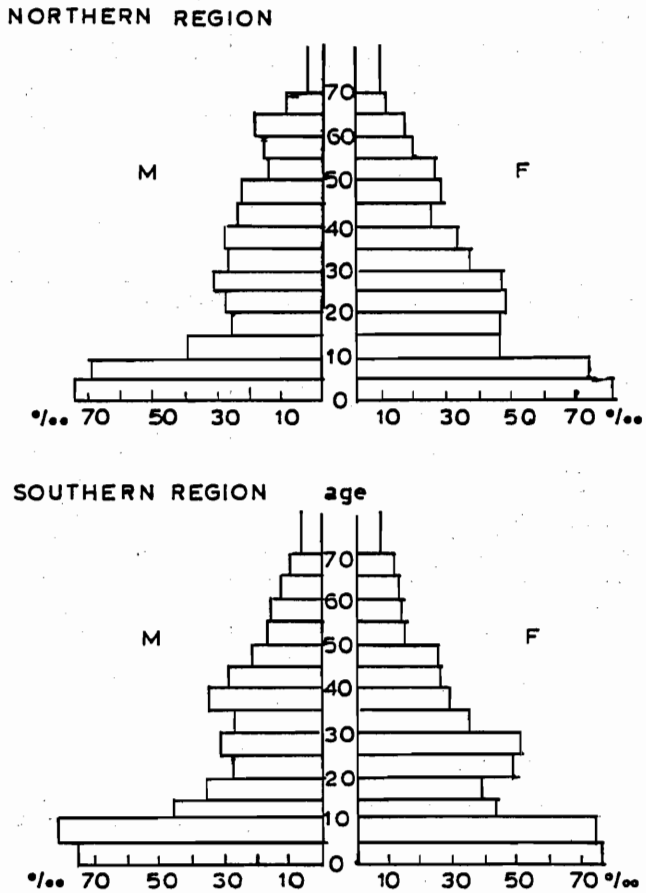


Figure 38. Age sex pyramids - rural interior delta Mali

the family has obvious importance for its effect on the amount and type of labor available for agriculture. Some writers (e.g. Ernst 1976:133) go further, and assert that the size and structure of the family as a productive unit affect productivity and also willingness to invest in equipment like plows and oxen.

A Marxist view of the situation in Mali as a whole (Ernst 1976:121 ff) sees households as representing a continuum of decay of the extended family: (1) the extended family, acting as a single production unit; (2) several production units within the extended family, which continues to exist as a social unit; (3) nuclear families as economically independent production units, still forming part of an extended family, and still exchanging labor among themselves, and (4) the nuclear family as a completely independent economic and social unit. The power behind the fission of the extended family is the growth of individual production at the expense of communal production:

> "As the economic importance of the...(individual field) can only grow at the cost of the...(communal field) i.e. of the traditional system of production and distribution, this leads to a conflict sooner or later between the producer and the extended family.... Basically, it is the social expression of the contradiction between the necessity of the productive forces to develop and the historically out-dated character of existing production relations" (Ernst 1976:122).

The demographic inquiry for the interior delta as a whole showed that, in rural areas, family size was relatively small (average 4.3 persons (M.I.S.E.S. 1961:II:172), and usually monogamous (49%, cf. 9% polygamous, 19% including persons outside the nuclear family, 18% with one or more spouse(s) absent). On the average, household (defined as the persons cohabiting in a compound) size was small -- most families held 0 - 4 (45.7% or 5 - 9 (36.8%, M.I.S.E.S. 1961:II:182) persons, with an average of 1.4 families per household (op. cit. 189). In general, the relationship between married males was son-father (9%, op. cit. 164), or brother-brother (14%); 64% of households contained only single families.

Unfortunately, only a study of budgets (M.I.S.E.S. 1961a:16) from the interior delta discusses the relationship between economic factors and family size. Overall, cultivators of rice had smaller household size (average 8.7 persons) than did non-rice-cultivating households (10.5 persons on the average -- mostly cultivators of millet on the unflooded plains). Within the group of rice cultivators, households owning a plow were, on the average, larger (11.1 persons) than were households without a plow (7.6 persons average).

Two sorts of demographic data are available for the interior Niger delta: administrative censuses were carried

out over a period of years between 1948 - 58 (summarized in Gallais 1967:18 ff), and detailed studies were carried out by the Mission Socio-Economique du Soudan (M.I.S.E.S. 1961) in sample communities of the traditional part of the delta. Gallais (1967:19) estimated the total population of the delta to be 423,500.

As with most regions in third world countries, population size shows the effects of a colonial regime. Famines, caused by drought or by the predation of Locusta migratoria migratoides had been frequent until 1940 - 45 (Gallais 1967:164 ff), as had epidemics of smallpox, cerebral meningitis, and flu. Under the French smallpox vaccination campaigns started between 1930 - 40, and other improvements in health care followed. During WW II, the French put pressure on farmers to increase grain production, and to set up village granaries. In addition, they introduced manioc, which, having underground tubers, is not susceptible to locusts. The effect of these medical, agronomic, and administrative rulings was, predictably, to lower mortality rates.

Taken as a whole, the interior delta shows low population density, some 14/km^2 (1959 Gallais 1967:19). This is notably less than, for example, Kano province in Nigeria, or the Serer region of Senegal (Lericollais 1972) -- both

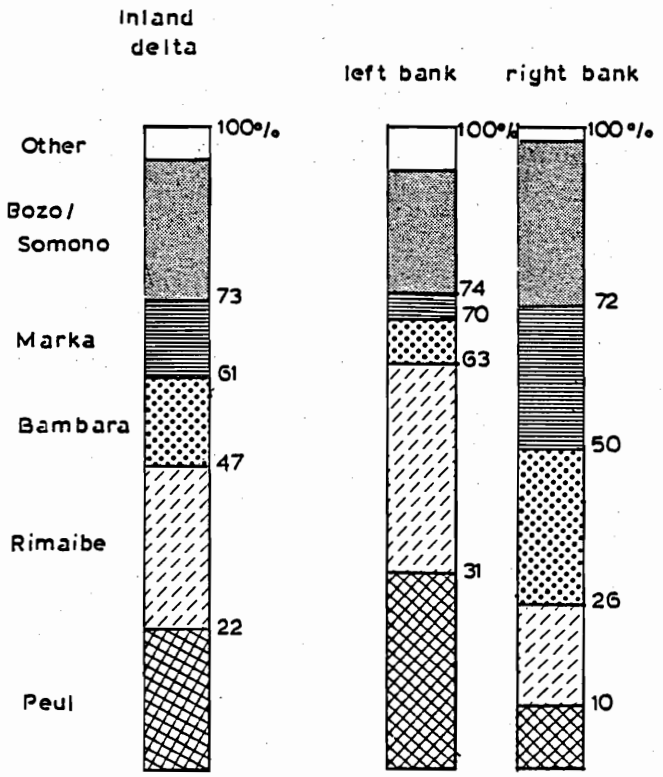
regions of dense settlement and of intensive cultivation. Indeed, the interior delta of the Niger is less densely peopled than the upstream Niger valley, or than the basin downstream.

Population density is not uniformly distributed over the region. When one omits urban population (as well as excluding land area covered by lakes), the general rural density is 10.94/km^2 (Gallais 1967:177 ff). However, calculating local density (in 36 km^2 quadrants), one finds that, even outside cities, population is clustered, with 59.8% of the rural population living in areas with local density above 25/km^2. In terms of environment types, the banks of the major waterways (the Niger, Diaka, Bani) are densely occupied, holding large, nucleated villages of fishermen and boatmen (mostly Bozo and Somono). The marshlands, in contrast, are only sparesely settled. The <u>rivage</u> -- the band between the marshes and the high, unflooded plain -- is densely inhabited on the right bank, but only sparsely inhabited on the left. The same pattern holds true for the high plains which border the inundated regions. Gallais attributed this difference in density of human settlement to geographic and historical factors. The right bank is morphologically "younger" than the left: there is more variation in relief, and micro-environments are better

defined. In addition, one of the important waterways of the left bank had filled with silt in the recent, pre-colonial past, so that it no longer flooded. The historical differences between the regions stem from the 19th century; it will be remembered that the left bank had been laid waste by the Toukolour, while the right bank had prospered.

Figure 39 shows ethnic composition: it will be seen that, of the groups concentrating on rice agriculture, Rimaibe predominate on the left bank; Marka on the right bank (M.I.S.E.S. 1961:I:12). Our typical Rimaibe village, located on the left bank, is small, consisting of some 100 inhabitants. Marka villages tend to be larger, some 400 - -500, and are often located on or near the marshes (Gallais 1967:173).

From the mid-15th to the mid-17th century, when Timbouctou and Djenne were important markets in the trans-Saharan trade, the agricultural productivity of the interior delta has been high. At this time, chronicles record use of money to pay for agricultural and herding products (Gallais 1967:85). This sort of trade continued until French conquest, although political unrest and military conquest weakened its importance. The history of the marketing structure established by the French is complicated, and will not be discussed here (see Suret-Canale 1971:155-300),



(MISES 1961:II: 25)

Figure 39. Ethnic composition of the inland delta by subregion

except to say that not all policies were disadvantageous to the producers. Prices for rice were actually subsidized.

The reports of the 1957 - 58 budget inquiry (M.I.S.E.S. 1961a) will form the start of our discussion. The aim of the study was twofold. It sought to compare income levels and household budgets for people living within the Office due Niger with those of people living outside it (i.e. the "traditional" zone of the interior delta). Within the traditional zone, the study wanted to compare household budgets for those engaged in different kinds of agriculture (i.e. rice cultivation on the inundated zone with slash-and-burn cultivation of millet on the unflooded borderlands), and also to compare the production levels and incomes of families owning an ox-drawn plow (an innovation advocated by French administrators), with production and income of families lacking a plow.

At the time of investigation, family budgets showed that cash needs included taxes (6 - 11% of cash income) and a variety of imported manufactured goods (8 - 34% of cash income). The plow was already in widespread use: 47% of Rimaibe households owned one.

The two most important routes between Mali and the coast are the Bamako-Dakar railroad, and a rail and road route between Abidjan and Bamako (Steedman et al 1976:51).

Transport along the Niger River from the central delta to Bamako is not always possible; one section of the river is impassible during parts of the year (Suret-Canale 1971:206). Although primary road networks are sufficient in many parts of the country, feeder road networks are not, and many villages are inaccessible during the rainy season. On the interior delta, the rice-cultivating village of Daga was accessible only by canoe, during five months of the year. Steedman and others (1976:53) contended that the state of the transport system seriously constrained the marketing of crops. In some cases, transport costs exceeded the prices paid to producers.

At the time of the budget study (1957 - 58, M.I.S.E.S. 1961a:47), cultivators in the traditional zone of the interior delta gained the largest part of their income from the sale of rice (56.8% of cash income for families owning a plow, 37.1% of monetary income for families without one). Millet ranked next, as a cash crop, followed by garden crops (corn, karite, peanuts, cotton, tobacco, fruits and vegetables). A national study, roughly contemporary with that of M.I.S.E.S., (cited in Ernst 1976:121) found that 15.6% of the area of fields worked by the whole extended family were devoted to cash crops, while, for individually owned fields, the proportion was

23%, divided between cotton (4.1%), peanuts (12.8%), and rice (6.4%). Much of the marketing is on a small scale; for example, rice is traditionally sold by household members who prepare a few kg. of paddy each week, spending the proceeds mostly on condiment ingredients (Gallais 1967:206). To discuss more recent developments in crop marketing, it is necessary to digress, and to describe national policy on agricultural prices.

After independence, Mali established state trading organizations, with monopolies on the buying and export of agricultural products, and on the importation and wholesaling of consumer goods (Ernst 1976:141). On the local level, cooperative and mutual aid societies were formed, and private trade was outlawed by 1964-65. Figure 40 shows official producers' prices for white paddy, as well as total estimated annual rice production, for this period.

During this period, the prices paid for agricultural products by the government were deliberately kept low, in order to keep down (urban) consumer prices for staple foods (Jones 1976:299-300). At the same time, however, the general price index rose from 100 (1959) to 168 (1966) for goods the farmers themselves bought. The general price index actually understates the inflation experienced by farmers, since their consumer cooperatives

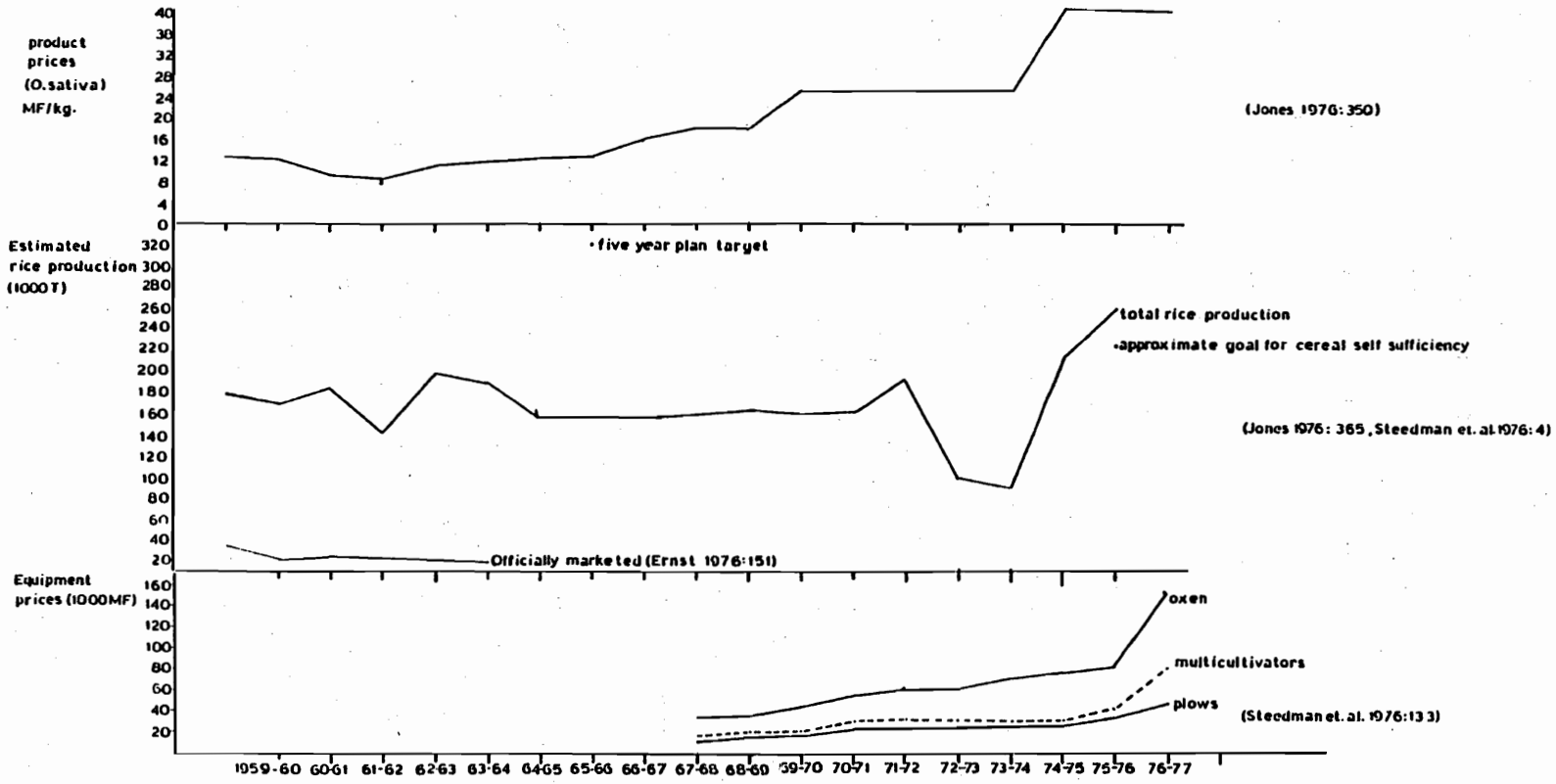


Figure 40. Producer prices and total production of rice - Mali 1959-1977.

seldom received goods to be sold at official prices.

Looking again at Figure 40, it is evident that declines in rice production coincided with the suppression of private trade, and also that only infinitesimal amounts of rice produced were being marketed through official channels. In most commodities, black market (or parallel market) trading expanded, and prices on the parallel market soared. By 1964 - 65, official estimates were that 85% of rice produced (outside the Office du Niger) was traded on the black market (Ernst 1976:147).

In the years after 1966, however, government prices were raised and production increased, somewhat. The share of the state trading company, OPAM, in total marketed cereals has varied between 15% (1968 - 69) and 50% (in the years during and after the drought). In its efforts to stabilize grain prices, however, OPAM has been hindered by organizational problems. For example, financing for grain purchases is often delayed until well after the start of the harvest (when prices are most depressed). Another problem has been that administrative marketing "quotas" are inflexible (and often underestimate surplus). Private traders still fill an important role (Steedman et al 1976:109 - 115) because they can buy more flexibly than can OPAM.

Steedman and others (1976:x) describe the situation after the drought:

> "Producer prices were raised in 1974. However, despite inflation and the existence of significantly higher prices for the same crops in neighboring countries, they have not been raised since. Meanwhile, the government has removed subsidies from agricultural implements, and their prices have risen substantially in the past two years. Fertilizer prices have also gone up. These developments have given to some the impression that the Malian farmer is supporting the rest of the population, which in effect means townspeople. As one official expressed it to us, "the farmer has had enough of subsidizing everyone else."

After the sale of agricultural produce, a second important source of income for cultivators in the traditional zone of the interior delta is fishing. For cultivators owning a plow (1957 - 58, M.I.S.E.S. 1961a:48) the sale of fish represented 21% of money income, while for those not owning one, the contribution was much smaller (9%, M.I.S.E.S. 1961a:48). The reason for the discrepancy is that fishing is carried out at the end of the dry season, when waters are lowest (see Fig. 31). Cultivators owning a plow completed their land preparation earlier than did those without a plow, and so had leisure to fish. Plow owning farmers also, sometimes, traded surplus rice for fresh fish, then smoked the fish and resold it.

For members of households without plows, commerce in local products and in products from other parts of Africa

(particularly kola) played a larger role than in households with a plow. The production of matting -- for wrapping fish -- also contributed to household income.

Because of differences in the timing of agricultural tasks for millet and for rice, it is possible for cultivators from one zone of the interior delta to work in neighboring regions. Thus, after the start of the rains, and after the first weeding of rice, many rice farmers work hoeing the millet fields, and are paid in cash (100f/day, Gallais 1967:210). After the millet harvest is finished, many of the millet farmers help with the rice harvest, which follows. They are generally paid in kind (1/10 of the harvest, M.I.S.E.S. 1961a:42).

During the dry season (ibid.) it was common for cultivators to go to nearby urban zones (Mopti and San) and to the Office du Niger, seeking work in house repair, dyke construction, and road repairs. Migration to more distant parts, to more developed agricultural areas (like peanut-growing regions along the Kayes-Bamako railroad, or cotton-producing districts around Segou-Koutiala) within Mali, and to agricultural labor in cocoa, coffee, palm products, and rice in the Ivory Coast, is widespread. There is anecdotal evidence that emigration from rural areas increased as real income for farmers in those regions declined, during the 1960s (Jones 1976:301).

In spite of methodological problems with the M.I.S.E.S. budget studies (1961a), the data are valuable as order-of-magnitude estimates. It is also possible to make rough comparisons among groups, and to compare data with 1971-72 estimates of per capita agricultural income (Steedman et al 1976:14 ff).

In total income, farmers in the Office du Niger (9684 FCFA/cap/year) exceeded those in the traditional zone (6957 FCFA/cap/year). Most of the difference was in cash income rather than in subsistence crops consumed within the household. Within the traditional zone, for rice-cultivating Rimaibe, per capita annual cash income of members of families owning a plow was considerably higher (2118 FCFA) than for members of families not owning one (1193 FCFA, M.I.S.E.S. 1961a:41), as were on-farm consumption levels. In fact, consumption of foods produced on the farm were as high for plow-owning farmers within the traditional zone, as they were for farmers in the Office du Niger.

When per capita income for all families within the traditional zone was tabulated by ethnic group, there were only relatively small differences among groups (M.I.S.E.S. 1961a:35). Interestingly enough, there were inter-ethnic differences in per capita income among

colonists of the Office du Niger. The Miniankas, a group from southern Mali (who, in their homeland, practice an infield-outfield type of cultivation similar to the Hausa (Malgras 1960) had the highest per capita income of ethnic groups within the Office du Niger. Instead of farming rice and cotton exclusively, many of them had concentrated on horticulture, and sold garden produce to the other settlers (Dumont 1957:107).

Of course, one of the reasons for differences in income between groups of farmers is that some -- those in the Office du Niger, and those owning plows -- were using greater capital inputs to farming. Any generalizations on their overall welfare must include capital costs in family budgets. Office du Niger colonists were given cash advances at their entry into the project, and their indebtedness was steadily mounting at the time of the M.I.S.E.S. study (to an average of 39,300 CFA/family in 1957, M.I.S.E.S. 1961a:44). By the mid-1960s (de Wilde 1967:254), advances in credit totaled some 164,000MF per settler, which had to be reimbursed to the Office within 2 - 3 years. In addition, the Office levied charges on rice cultivators of 400 kg. of paddy/ha, in addition to 10 per cent of the harvest charged for threshing (ibid:267).

Figures are not available for the cost of ox teams and plows during the colonial period, but maintenance of equipment alone took 32.6 per cent of cash income during the period January - April, for farmers owning plows (for non-owners, the figure was 0.1%, M.I.S.E.S. 1961a:66). Prices for ox teams, multicultivators, and plows are shown on Fig. 40 for 1964 (within the Office du Niger), and for 1967-1977. During much of the 1960s, credit was not easily available (Jones 1976:303) for equipment purchases. Prices on equipment had been subsidized until 1976 (Steedman et al 1976:87 ff), and credit could be extended for a maximum period of two years. When subsidies were removed, the repayment period was often extended for three years.

Recent data (1971-72, cited in Steedman et al 1976: 15-16) for per capita annual income in rural areas shows the Delta zone to have extremely high levels (39,700 MF, net of taxes, cf. 29,800 MF for Office du Niger, and 19,900 MF for Mali as a whole). These figures, however, include income from livestock, and so are not strictly comparable to incomes for rice cultivators. It is likely that current income levels are less high than those for 1971-72 because of the effect of the drought on livestock populations.

By the 1930s, French agronomists (Viguier 1939) knew most of the problems of traditional rice cultivation methods in the interior delta. The varieties used (floating types of Oryza glaberrima) were unresponsive to fertilization, could not be mechanically cultivated, harvested or threshed, were low yielding, and were unacceptable on the world market. The flooding regime of the delta was irregular, and crop failure was common. Cultivation was carried out entirely by human labor; methods were haphazard, and the year-to-year displacement of rice fields precluded soil amelioration.

By the end of the 1940s, a number of approaches to these problems were being tried: introduction of O. sativa varieties, the use of ox-drawn plows, partial, small-scale water control systems (polders), and large scale irrigation works. Near the end of the colonial period, these programs were evaluated in the M.I.S.E.S. studies, and in those of M.E.A.N. (Mission d'Etudes d'Amenagements du Niger, reported in Guillaume 1960). Assessments of different programs makes it possible to clarify the alternatives available to Malian planners at independence.

The first program to introduce O. sativa varieties started in 1914, and efforts have continued to the present. Unfortunately, O. sativa is much less tolerant of submersion

than were "late" types of O. glaberrima, being able to withstand only one meter (Gallais 1967:230, Viguier 1939:124). To some extent, O. sativa varieties have been accepted by native farmers as substitutes for the "early" O. glaberrima varieties, and are planted in high fields, or in areas under partial water control.

The ox-drawn plow was introduced to the delta in 1925 (Gallais 1967:231). Although adoption was slow until 1945, the plow rapidly gained popularity after that date until, by 1957-58, 47% of sampled rice farmers owned one (M.I.S.E.S. 1961a:10). The hope was that the plow would permit deeper working of the soil, the ownership of oxen would increase use of animal manure, and the increased efficiency of land preparation (5 - 10 ares/day/worker, instead of 2 - 5 ares/day/worker with the daba hoe), would permit each worker to cultivate a greater surface. There is evidence that families owning plows had higher income, and higher consumption levels than those not owning plows. The question remains, however, whether this correlation meant that plows raised agricultural productivity, or that prosperous families were the ones who could buy plows.

To answer this question, a detailed study was carried out in Severi (a predominantly Rimaibe village near

Wandiaka; Gallais 1967:233 ff), between 1949 (when plows were used for 25% of cultivated area), and 1958 (when the proportion was 86%). During that period, however, overall per capita cultivated area in rice declined, partly due to a succession of poor flood years. In addition, the distribution of cultivated area per capita became more uneven: compared with 1948, there were many more people in the highest and lowest groups of per capita cultivated land, and amount of land per capita corresponded to lineage prestige (i.e. the rich got richer and the poor, poorer). What had happened was that plow owners were, in many cases, lending equipment and oxen to prepare the fields of others (often families where some members had emigrated in search of work), in return for help during other parts of the agricultural year (particularly at weeding and harvesting).

Land preparation, although arduous, can be carried out over a relatively long period (see Figure 31). In contrast, hand weeding and hoeing must be completed within a short period, and harvesting is even more exacting in its scheduling. It is these operations which are the bottlenecks in traditional rice farming (where water control is absent): by hand, a worker can prepare 2.5 - 5 ha, but he can only hoe and weed 2.0 ha, and can harvest perhaps 1.5 - 1.6 ha

(Gallais 1967:241). Thus, the use of plows alone cannot greatly increase productivity.

Several means to bypass the bottleneck of weeding have been tried. In the Office du Niger, deep plowing with tractors was tried (see below) to extirpate O. perennis; instead, it exacerbated O. brevigulata infestation. Pre-irrigation of fields, followed by transplantation of rice, proved too costly in labor. Within polders, seeding in lines has been tried, followed by animal-driven cultivation before the area is flooded (Steedman et al 1976:232). However, outside water control projects, no method has been found to mechanize weeding. As for harvesting, the use of combines on the lands of the Office du Niger proved disastrous (Dumont 1957:105), and harvesting in pilot projects is still carried out by hand (Steedman 1976:232).

A third approach to improving rice cultivation, suggested by Viguier (1939) was through partial regulation of the floodings. The timing of the start of flooding is important: if the fields are flooded too quickly, the young rice plants are liable to asphyxiation and to the predations of rice-eating fish. If waters recede too rapidly at the end of the floods, yields suffer. Polders, protective dykes surrounding fields, with adjustable gates (equipped with a grill to keep out fishes)

permit the farmer to regulate inflow (retarding flooding), and can retain waters after the floods' recession. Often, polder dykes could be planned to utilize previously existing natural levees.

Between 1943 - 51, small-scale polders were constructed, containing in all some 49,350 ha. However, the builders did not take into account the extent of possible variation in flood levels. Thus, when the floods of 1951 surpassed records for the previous decade, the dykes were not sufficiently high to afford protection. Another problem was that lands within the polders were not leveled, and drainage was often poor. In all, only some 13% of the area protected by these polders had been brought into cultivation by 1957 - 58 (Gallais 1967:243).

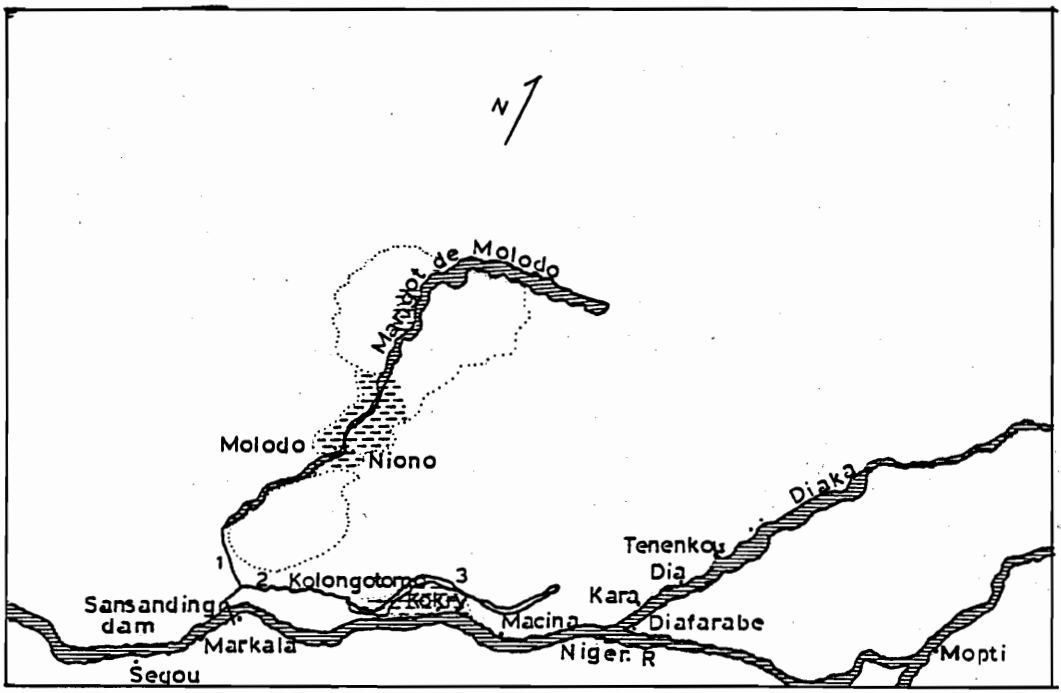
Sometimes, however, these projects had unexpected successes. Construction of one particularly large polder (planned before 1950) had not been completed by 1958. However, farmers, on their own initiative, had occupied the high ground bordering the canal, had planted mixed gardens of O. sativa, maize, manioc, and millet, and were irrigating the gardens by cutting through the canal walls. Yields were excellent -- up to 2.5 t/ha (Gallais 1967:245).

There is, however, some evidence that within polders there was a larger increase in cultivated area per worker

when farmers were given plows (2.05 ha/worker without plow, 2.98 ha/worker with a plow, in Diaka; Gallais 1967:249).

In spite of the problems with polders, at least one evaluator (Guillaume 1960:397) felt that, with development costs of about 35,000 fr/ha, assuming yields in the polders of about 1.2 t/ha, polders gave a better return to investment (41.4%) than did larger-scale irrigation projects like those at the Office du Niger, discussed below. Influenced in part by this assessment, the national 1961 - 66 five year plan for Mali invested heavily in development of new polders, and the results of these will be discussed below.

The largest and the most expensive project initiated by the French was the Office du Niger. Since it has been much evaluated (M.I.S.E.S. 1961, 1961a, de Wilde 1967, Jones 1976:305 ff, Steedman et al 1976:222-26), and since much of the literature is in English and is easily available, discussion here will be brief. The original proposal, made in 1929, utilized two natural waterways which had been closed with alluvial and aeolian deposits, the Fala de Molodo and the marigot de Boky Were (see Figure 41, Guillaume 1960:274 ff). Lands fed by the Fala de Molodo were to be used mostly for cotton production, while those on the marigot de Boky Were, where soil was heavier and



1 Sahel canal
2 Macina canal
3 Marigot de Boky Were

(Guillaume 1960:274)

..... limit of irrigation system

irrigated area

Figure 41. Irrigated areas of the Office du Niger

had higher clay content, were to be devoted to rice.

Much of the construction work for the project was carried out by forced labor from Mossi country (Suret-Canale 1971:249). Work conditions were poor, and discipline was harsh. When forced labor was abolished in 1945, many seized the chance to leave (de Wilde 1967:252).

The project, as established in 1932, had three aims: to relieve the dependence of the French textile industry on imported cotton, to provide a dependable grain supply to relieve local famines, and to relieve over-population in the Mossi country of Upper Volta. In its lifetime, however, the project has served another purpose -- it has been a testing ground for a number of innovations aimed at intensifying land use: cotton production as a cash crop, various sorts of crop rotations, capital-intensive mechanization, and rice cultivation with transplanting, in addition to irrigation itself. The Office du Niger has cultivated lands itself (with the help of wage laborers), as well as cultivating lands through settlers recruited from outside the delta. Originally, most settlers were Mossi, but after 1950, new colonists were predominantly Bambara and Minianka (de Wilde 1967:252).

Many of the initial problems of the system were due to the fact that design of the irrigation infrastructure

was, in some ways, based on insufficient knowledge (ibid. 262 ff). For example, an attempt to grow Egyptian long-staple cotton failed because rainfall had been badly underestimated (Guillaume 1960:282). Another problem was that the system, as planned, could not compensate for lack of rains at the beginning of the growing season. Original plans did not include information on micro-relief, and fields were not properly leveled. Farmers were unable to clear and to level land with hand tools and ox-plows, and, by 1948, 9,000 ha out of 25,000 ha cultivated land had been abandoned.

Starting in 1948, tractors acquired under the Marshall Plan were used for clearing, leveling, and plowing the fields of colonists. In addition, the Centre rizicole mecanise (CRM) was established at Molodo, for direct, mechanized farming, using wage labor. On fields worked by settlers, the use of tractors proved extremely expensive and, in some cases, harmful (e.g. deep plowing, mentioned above, aimed at extirpating Oryza perennis, actually exacerbated O. brevigulata; Guillaume 1960:290). Overall, yields for rice (1,805 kg/ha) and for cotton (868 kg/ha) were only slightly higher in the Office du Niger for the period after mechanization (1949-55) than they had been before (1941-48 1,671 kg/ha rice, 668 kg/ha cotton;

Guillaume 1960:305). Although costs for mechanized cultivation rose substantially between 1950 and 1958, prices for cotton rose only slightly, while those for paddy actually fell (ibid:304). Starting in 1958, management tried to persuade settlers to return to the ox-drawn plow. Mechanization in direct farming fared no better -- costs at Moldo were extremely high, and, without hand weeding, the fields became badly infested with weeds (ibid:308). Yields were low for the Molodo project, and the operation required subsidies until its abolition in 1960 (de Wilde 1967:283).

Attempt to intensify land use in the Office du Niger through crop rotation all met with failure. Originally, cotton lands were to be planted in a cotton-sorghum-peanuts rotation, but soils were not well enough drained for sorghum, and peanut yields were poor. The use of a green manure (e.g. *Crotalaria retusa*) during fallow periods of rice cultivation was similarly discontinued within a short time (Guillaume 1960:295). It was thought (ibid:297) that a rice-cotton rotation, in which rice straw was plowed under, would improve soil structure and would help control weeds. However, the two crops demanded different types of soil preparation, and had differing water requirements. Under that rotation, rice yields declined slightly

over several years (1954 - 58), while cotton yields declined 26 - 55% (ibid:298).

By 1960 it was possible to evaluate the project and its effects. Studies by M.I.S.E.S. had shown that, although the income of colonists was higher than for residents of the traditional zone, settlers were under a crushing burden of debt. Although nutritional intake was much the same as in the traditional zone as a whole, animal protein comprised a smaller part of the diet, and diet was less varied than for the traditional zone. The costs of land development alone had been immense: 185,200 fr/ha for cotton-rice land, and 183,000 fr/ha for rice land (Guillaume 1960:288). The total investment had been approximately 44 billion CFA (in 1960 value; de Wilde 1967: 247), or $175 million, and administrative costs were enormous.

Evaluating the Office du Niger in terms of its original aims, Guillaume (1960:394) found that, after 25 years, cotton production was still extremely low, and that the CDFT (Compagnie francaise pour le developement des fibres textiles), after only seven years, was having far better success in encouraging non-irrigated cotton production in the higher rainfall zones of southern Mali. In terms of rice,

the Office du Niger was too distant from the coast to compete effectively on world markets. In terms of production for local use, polders gave a far higher return to investment than did the Office, assuming normal flood conditions. Of the estimated total irrigable surface of 960,000 ha, only 48,430 ha had been brought under cultivation (ibid:275-79).

After independence, the first five year (1961 - 62 to 1965 - 66) plan for national development, as it affected the central delta, aimed at a continuation of agricultural policies under the French: encouragement of the use of ox-drawn plows, expansion of rice areas under polder (by 52,000 to 67,000 ha), and expansion of irrigated land at the Office du Niger (by 60%; Jones 1976:272 ff). In addition, cotton production on the Office lands was to be intensified, and yields raised to 2 T/ha, by use of "super-leveling," insecticides, and fertilizer. Rice yields were to be raised to 2.5 T/ha, by the use of transplanting. Mechanized farming was to be encouraged on Office du Niger lands.

Of these programs, adoption of the plow had the greatest success, for the nation as a whole. Demand was strong for plows, carts, and chemical fertilizer, and, indeed, import levels were too low to meet it (Jones (1976:303).

In spite of distribution problems, number of plows in use increased by 148% between 1960 - 61 and 1966 - 67.

By the end of the plan, targets for area to be developed in polder has been exceeded, but only a small part (estimated 29 - 42%) of the land within polders was actually under cultivation. Poor planning seems to have been partly responsible; for example, one polder was so high that, in average years, it received no flood waters at all. The land seems not to have been well leveled, and farmers using the new polders received little or no technical advice. At the end of the plan, average rice yields from polders were only very slightly higher than those for areas with no water control.

Within the Office du Niger, intensifying rice production through transplantation was supposed to reduce weed populations, and to allow a longer vegetative period (rice plants could be started earlier, since nurseries required less water than did fields; de Wilde 1967:267). However, the time requirements of transplanting (105 - 125 man-days/ha total, compared with 45 - 60 man-days/ha total for direct-sown rice) were formidable. Moreover, transplanting coincided with the peak in labor needs of cotton. Few settlers adopted the practice, and area under transplantation declined after 1962, being negligible by 1964.

Intensification of cotton production faced some of the same problems, and was really only successful in one settlement (Niono, de Wilde 1967:296), which had always been unusually prosperous and well managed. Total area cropped in cotton on the Office du Niger actually declined by 36% during the FYP (Jones 1976:275).

Looking at Figure 40, where the 1966 target for the FYP is compared with actual production of paddy rice, it is obvious that reality fell far short of goals. Most of the shortfall was in polder cultivation (where production was 17% of goal), and in the Office du Niger (which achieved 47% of production goals), while traditional rice production exceeded plan targets (Jones 1976:308).

In the years after the first FYP, Mali began to establish "Operations," or regional agricultural development projects (Steedman et al 1976:33). For the interior delta, the important Operations are Riz Mopti (which receives funds from the World Bank), and Riz Segou (funded in part from the European Development Fund), as well as the Office du Niger. Polders of the two Operations were expanded from 23,000 ha in 1972 to 40,000 ha in 1975 (ibid:10).

During the drought years of 1972-73 and 1973-74, production in these polders was low. Only 20% of the area in the Riz Segou polder was harvested during those years. The Office du Niger, in contrast, was able to cultivate the same area as in 1970 - 71, and its contribution to total domestic rice production increased to 65% (1972 - 73, compared with 26.5% 1968 - 69; Steedman et al 1976:223).

In the years since the drought, Mali aimed at self-sufficiency in cereals by 1979; in rice, production goals are shown in Figure 40. National planners (ibid:41-43) have favored increases in per capita rice production because: (1) rice (because it is grown in relatively few locations, and because it requires milling) is more easily government controlled than other cereals, (2) total irrigation permits cultivation even during drought, and (3) rice production is more intensifiable than millet or sorghum.

The use of animal traction in the projects Riz Segou, Riz Mopti, and the Office du Niger had increased, overall, between 1968 and 1972 (ibid:97). Steedman and others (1976:95) found evidence that the rate of adoption of animal traction had accelerated, in the years since the drought, in spite of increases in prices for equipment and for oxen.

By 1970, the use of chemical fertilizer in rice cultivation had been introduced in the Office du Niger,

and in the polder projects. In the years since then, fertilizer use in the Office du Niger increased (ibid: 106 - 7). In the polders, however, the low proportion of land harvested during the drought made farmers reluctant to apply fertilizer. In addition, fertilizer exacerbated the problem of weeds, and extensionists recommended its use only to farmers who were seeding in rows (and able to use horse-drawn traction for weeding).

By 1975 - 76, rice production exceeded the goals set for 1979. Steedman and others (1976:122) attributed the surplus to: farmers' hedging against another drought year in 1974 plantings; price increases in 1974; and to deliveries of drought-relief grain after 1974. They summarized:

> "Even with a return to more normal circumstances, we conclude that Mali is basically in a position of self-sufficiency today....Cereals, it would appear, are being produced and stored in quantities that are still unmeasurable and in response to dictates that are still imperfectly understood; but the capacity to produce seems to be in place."

Detailed, ethnographic descriptions of single communities are not available; the focus for the studies we have discussed here was regional rather than local. Farm management data are also lacking. Available information on the interior delta was, for the most part, gathered in order to explain the success or failure of a number of

technological innovations. It is easier, therefore, to discuss intensification in terms of technological change, rather than in terms of demographic or economic factors.

It is difficult to assert that the reason for failures in planned intensification programs were due to ancient, deep-seated disinclination on the part of the residents of the delta. Historically, there had been a period (1450 - 1650) when the delta had prospered, and when production had included crops (barley, cotton) which have not been successfully re-introduced since.

Rice appears to be a "culturally preferred" food. Dietary studies (M.I.S.E.S. 1961b:13) showed that rice dominated the intake of all ethnic groups within the inundated zone of the delta. Figure 30 summarized local consumer preferences in types of indigenous rice. On a wider scale, income elasticity of demand for rice (0.5) is estimated to be greater than for millet and sorghum (0.2, cited in Steedman et al 1976:42), so that it is likely that increases in levels of income will lead to substitution of rice for other cereals. Bourke noted (1965:48) that, in many other parts of Africa:

> "The attraction of the rice crop is such that it has led to the abandonment of ancient tribal customs whereby rice cultivation was restricted to women."

In general, however, rice farming in the interior delta has traditionally been extensive. The locations of fields is shifted in accordance with rainfall and flood levels and labor inputs to rice cultivation are relatively low. There is, however, evidence that there is internal variation in the intensity of traditional cultivation. People seem prone to start garden plots on the canal banks of an unfinished polder project. In addition, there is evidence that cultivation techniques for small, individually-owned garden plots are more intensive than for larger, communal holdings. Unfortunately, the literature on agriculture in the interior delta gives little attention to garden cropping. We know almost nothing about yields, and about prices paid to producers in the marketplace, and we have no detailed information on techniques used in gardening.

The last question for this section is whether some ethnic groups "naturally" farm more intensively than do others, as, e.g. Viguier (1939) suggested. As we noted, however, the inter-ethnic differences he suggested could plausibly be explained by differences in population density between regions.

This case study started by discussing the risks involved in rice farming in the traditional zone of the delta.

Techniques for lessening the risk of total crop failure included cultivating fields at several elevations, changing field locations to compensate for changes in flood levels, and planting a mixture of rice varieties in many fields.

This diversity of techniques and spreading of risk runs counter to the needs of capital-intensive, mechanized farming. While wild rice (Oryza perennis) can be tolerated, to some extent, on traditional rice fields (and, indeed, can be harvested in times of crop failure), wild rice infestation on mechanized fields reduces yields substantially, and no successful means have been found of ridding fields of this weed. Oryza sativa is the crop of choice for mechanized agriculture, but it is less hardy than O. glaberrima, and less tolerant of variations in flood levels. Thus, outside the Office du Niger, Oryza sativa has won only limited acceptance. Most important, though, large-scale projects seem to lack flexibility in decision making. Climatic and hydrologic variation from year to year require that farmers schedule tasks carefully, taking into account variations in micro-relief. In the Office du Niger and in many of the early polder projects, micro-relief variations were not taken into account, yields suffered, and land leveling proved to be expensive.

Three of the main technological innovations tried in the interior delta were: total water control schemes, partial water control schemes, and use of the ox-drawn plow. Although total water control proved by far the most expensive of these innovations (in human terms as well as financially), it was also the only method that produced during the worst of the drought years.

The idea of partial water control (Viguier 1939) was a good one; it was based on detailed study of traditional rice techniques and their problems. In execution, however, there were difficulties: incomplete knowledge of the hydrology of the delta, poor construction, and lack of technical assistance to farmers relocated on the polders. Some of these problems seem to have been overcome since the FYP, and Steedman and others (1976:193, 232) recommend a "package" of partial water control combined with use of animal traction for plowing and cultivation, and use of planters for seeding in lines. Overall, they felt that partial water control schemes were a less costly alternative to total irrigation. The main disadvantage to polders is their inability to compensate for drought conditions.

The ox-drawn plow had first been introduced to Mali (Jones 1976:271) as a means of enabling farmers dependent

on rainfall to cultivate a single plot permanently, with the use of crop rotation and application of manure. As a means of intensifying land use in rainfall-dependent agriculture, animal traction was not popular.

When introducing the plow to the inundated zone, planners hoped to increase cultivated area per worker, as well as to intensify cultivation by increasing use of animal manure. Their expectations do not seem to have been realized: cultivated area/worker was only slightly greater for plow-owning families than for those lacking plows, and yields were only increased slightly. However, as a means to decrease the human labor necessary for land preparation, the plow had sustained success. Often, plow users were families lacking workers: it would be interesting to investigate a link between regional emigration rates, and rate of adoption of animal traction. At any rate, the standard of living for plow-owning families was high: their income levels approached those of settlers in the Office du Niger (without the burden of indebtedness), and their nutritional status was comparable to that of the colonists.

In order to see whether intensification in the interior delta can be understood in terms of population push, it would be necessary to gather data on the intra-regional covariation of population density, age-sex structure and farming techniques,

cultivated area/capita, and duration of cultivation and fallow period. Some of these data might be obtained by re-working the M.I.S.E.S. studies (1961, 1961a, 1961b), but the published analysis does not permit such efforts at correlation.

As a whole, the delta is less densely settled than regions where classic intensive cultivation is carried out (Serer, Kusasi, Kano province, etc.). Indeed, shortage of labor is often given as an explanation for the failure of intensification. The sorts of innovations which have been adopted (particularly animal traction, chemical fertilizer in the Office du Niger) are probably best viewed as an attempt to use low-level capital intensification to compensate for lack of labor. If there is a demographic factor influencing this sort of intensification, it is probably the exodus of the rural work force from the countryside, rather than increase in total population size.

There is evidence that farmers' production responded to changes in producer prices, and that policies of low prices for agricultural products acted to reduce the amount marketed through official channels, to reduce the cultivated area, and to increase the rates of exodus from the work force. It is also possible to argue that choice by farmers of cultivation techniques can be analyzed in economic terms.

A good example of this is in the response to pressure to adopt transplanted rice techniques. Figure 6 shows typical average and marginal products (in kg. of wheat equivalent/man-hour) for different levels of labor input. It will be noted that average product for direct sowing of rice in the Office du Niger (taking into account deductions for irrigation costs, etc.) fall at relatively low levels of labor input where (in Gambia, for example), marginal product has begun to drop sharply. Where the marginal return for labor in agricultural production drops below the return for labor used another way (e.g. wage work), it is to be expected that farmers will refuse to intensify. Another reason behind the failure to transplant, which was not taken into account by planners, is the increased risk of schistosomiasis infection for the workers.

If developers are to learn from the difficulties of planners under the colonial regime, and immediately following independence, they must realize that successful intensificatio can only be brought about through the use of market incentives, and through the use of innovations which find acceptance without political sanctions. Such planning must start from the assumption that indigenous farmers know the extent of environmental fluctuations and are better prepared

to make production decisions than are administrators with jurisdiction over a wide area.

Recent organization of agricultural development in Mali has been followed by impressive improvements: widespread use of animal traction, better constructed partial-water control systems, and large, recent increases in production. It must be through means which find spontaneous acceptance, and through the use of market incentives that these successes be consolidated.

Prospects for Intensification

In this section we discuss limits to, possibilities for, and repercussions of intensification to increase production in the West African savannahs. We consider the three related approaches of intensifying land-use, increasing technological efficiency, and stimulating a higher labor input/unit land emphasizing data that can be used to judge the prospects for intensification in a given area. We also suggest possible approaches for projects aimed at intensification and the problem of measuring responses.

It is not possible for us to provide a checklist for judging whether a particular area or a local population will spontaneously adopt intensive methods or respond to

outside initiatives for a more permanent and productive agriculture. But it does appear to be the case that certain factors are regularly connected with the process of intensification. Given a local environment where soil, water, and health conditions allow for more intensive land use, the process will move fastest where population pressure is growing and where the economic rewards of farming are most obvious. We advocate an ecological viewpoint that includes those geographical, technological, demographic, economic, and political variables that directly affect the decision making of the smallholder and that can only be gathered in most cases from observations in the field.

The most common soils of the savannah area (ferruginous) are quite vulnerable to degradation under intensive cultivation because of their thinness, the presence of indurated layers, and the lack of organic content. The high temperatures and amount of sunshine and the extremes of wet and dry prevent the build up of soil organic matter from the light vegetative cover. These soils are, however, responsive to manuring and can be productive under good management. When enough land is available for grazing and fodder, so that sufficient manure is produced, indigenous intensive systems can maintain adequate production without serious land deterioration. This appears

to be the case in Nigerian Hausaland today, and was probably so in Kusaok 75 years ago. Soils vary spatially, however, and there are some areas with very high potential for agricultural intensification, e.g. the eutrophic brown soils and the alluvial soils of river valleys whose utility is sometimes limited by the presence of onchocerciasis vectors, and, in the south, trypanosomiasis vectors.

The extreme variability of rainfall both spatially and temporally, which also affects surface water availability, e.g. in the Niger delta irrigation scheme, sets a limit on agriculture intensification and is dealt with by range of risk minimizing activities.

Farmers seek to minimize risk so that sporadic distribution of rainfall, variation in amount of rain from year to year, high winds, locusts and other pests do not completely wipe them out. They adopt a mix of strategies for spreading their risk such as dispersed fields, mixed cropping and changing varieties from year to year. They also modify the environment locally by manuring, crop rotation, and water control, for example. They must balance area planted against labor supply (mainly for weeding), and expected production against the amount of food needed to feed their families.

In the savannahs the indigenous and spontaneously adopted innovations provide a base of technical skills for dealing with the fluctuating environment, and must be considered in any program of intensification. This has often been overlooked. For many years it was assumed that mono-cropping was better than mixed cropping, and only recently has the error in preconceptions of developers been exposed. The careful use of manure and household wastes in northeast Ghana and northern Nigeria illustrates the perception on the part of the farmers of the necessity for maintaining soil structure and nutrient content under continuous cultivation.

Throughout our discussion of agricultural intensification, we have emphasized the regular and generally predictable process by which population pressure on resources and the economic benefits of market participation move farmers in the direction of more permanent land use and increasing labor inputs. Intensification took place in the past and proceeds today using indigenous crops, simple tools, and well-known local methods. In practically every farming society of the semiarid savannah, there are evidences in certain field systems, garden plots, or money crops of intensive techniques. On the principle that it is always easier to develop what exists rather than

substituting another practice or demanding radical change, the most effective way of promoting intensification may be to encourage what smallholders are already doing. A woman's vegetable garden on a refuse heap may perhaps be improved with better seeds and protected by minimal fencing. The few plants of tobacco a man carefully tends for his own use may well be multiplied if he gets a good price for them in the market. There is often a considerable range of cultivation activities within a single area, and many observers have commented on the experimentation done quite spontaneously by local farmers. Perhaps extension might disseminate the best of such home-grown methods for inter-planting, composting, water control, or scheduling. Farmers often have an excellent idea of what they need for more effective intensification and, given an opportunity, they will request treated seeds, shallow wells, or feeder roads for the evacuation of produce (Benneh 1975). An initial strategy of intensification might well leave the choice of crops and their proportions to local smallholders and promote methods that had already been proven under local conditions.

Those best qualified to successfully demonstrate intensive cultivation are obviously the people with previous

experience. As we would expect, they are likely to come from areas of higher than average density such as mountainous regions, peri-urban concentrations, rich river valleys, areas of exceptionally fertile soils, or centers of states and kingdoms. Such farmers often have the skills for intensive agriculture as well as the incentive of improving their standard of living. The opening of less densely settled land which is at the same time accessible to high population areas allows the zone of permanent land use to expand. This may produce more rapid and sustained effects than attempts to encourage intensive methods in areas of sparse population where shifting cultivation still provides an adequate livelihood. The seasonal movement of farmers from around Kano to the Soba area first brought some of the fadama land into use for sugar cane and introduced concepts of land rental, and the whole complex then passed smoothly into the local system. Permanent settlers from the Jos Plateau in Soba are the biggest users of chemical fertilizer (Schultz 1976). Even in such planned operations as the Office du Niger, some Minianka settlers have begun to grow vegetables on the dykes, using intensive techniques familiar to them from the past.

If people practicing their own brand of intensive agriculture have a repertoire that can be expanded and

techniques that can be spread both within and among communities, it is also possible that they are the most willing recipients for productive innovations from elsewhere. Just as the Kusasi planted and recognized the potential in American dwarf sorghum distributed to them as food, so the Kofyar borrowed a new variety of maize from their Fulani neighbors and acquired tomato seeds from Europeans, growing the new vegetable by novel irrigation methods. Intensive cultivators are alert to the differences in yield or hardihood that new crops display, and recognize the value of increasing labor inputs, both in terms of quantity and quality. More efficient use of scarce land resources has been crucial to their subsistence, and they respond to innovations that can demonstrably achieve such results. Rural development can thus build on techniques already present and mobilize the experience and motivation of farmers with a tradition of intensive cultivation. In our view, a major component of agricultural change is the presence of the right human resource -- individual farmers whose environment has led them to use intensive methods in some phase of their agricultural operation, and who have developed habits of work, investment, and calculation appropriate to these activities.

Many indigenous adaptations have either (1) been altered by the impact of colonialism and nationalism or (2) been rendered less suitable by a changing environment. Therefore it is not feasible to simply attempt to extend or intensify local practices without first examining their actual efficacy. It is, however, possible to select and encourage those local practices that are demonstrably most productive and show economic promise.

The population of the savannahs is not contributing its potential of labor to agricultural production because of malnutrition and disease. This is especially important during the labor bottleneck that occurs in the rainy season, when long hours must be spent in weeding, when food availability is at its lowest and malaria, dracunculiasis, and other infectious diseases have their highest rate of incidence.

High dependency ratios are caused by high mortality, high fertility,and a high incidence of adult morbidity (e.g. leprosy and blindness). In many areas, too, there is a high rate of emigration of the most economically active sector (males 15 - 45), further increasing the effective dependency ratios.

Besides weeding, the main input into intensive rain-fed agriculture is manuring, which implies animal husbandry.

Lack of capital and credit prevent restocking of animals after a drought period when they wither, die off, or are sold to purchase grain. This limits the labor that could potentially be used in non-weeding times in kraaling animals, caring for them, bringing in fodder, and scraping out and distributing the manure.

High population densities are often considered to be a positive factor in promoting agricultural intensification and consequently increased food availability (Boserup 1965).

There are others who also see possible positive aspects to population growth in the savannahs, pointing to the rapid rise in population that paralleled the industrialization in Europe and North America. Some (Engmann 1975 e.g.) see the problem as mainly one of distribution, pointing to the extensive areas of relatively sparsely populated savannah. These people often encourage resettlement, without considering the failures and tremendous expenses that have characterized past experiments with resettlement in West Africa.

The history and environment of West Africa today is vastly different from that of the industrialized countries during their own period of rapid population growth (Caldwell 1975a), however, and there is no doubt that colonialization

and neo-colonial economics undermine the ability of farmers in densely populated areas to remain self-sufficient. As Amin (1976) points out, African economies were developed as satellites to industrial economies during the colonial period, which mean that increased production was drained off to promote economic growth in Europe, and was not available for indigenous intensification and economic growth. The pattern has been somewhat modified today in that many of the rural resources go to supporting the burgeoning urban populations and prestige projects.

The point to be made here is that intensification and increased food availability/person do not necessarily go together. Pullan (1969) even considers intensification as indicating a breakdown of the extensive systems which are capable of maintaining soil fertility. In the Kusasi area we have seen that very high population densities are associated with and have undoubtedly encouraged an intensive system that is not now capable of supporting the population nor of maintaining soil fertility and production levels. Caldwell (1975a) notes that for West Africa in general there is <u>not</u> an association between population density and economic development.

Obviously crude population density is not an adequate indication of the propensity for intensification. Densities must be modified by considering the quality of the resource base (soils, water, cultigens, livestock), the technology applied, and the quality of the labor available. Labor quality will be affected by the health and nutritional status of the population and its age and sex structure. To make these determinations in an absolute fashion is extremely difficult and time consuming. Perhaps an indirect way to judge the potential of an area for intensification is to examine the age and sex structure of the population as an indication of the proportion of economically active (15 - 45) members who are leaving the area but this is open to criticism. When coupled with a survey of the areas concerned, conclusions reached can be much more reliable.

In northeastern Ghana, for example, population densities are high, populations undernourished, and land deteriorating. Sex ratios which are very low in the 15 - 45 age group clearly indicate that this area has passed the point where current techniques of intensification are capable of keeping pace with increasing population. Large numbers of migrant males are a sure sign that outside labor is more profitable than farming, and that local labor intensification may well not be a viable option.

This instance is perhaps an extreme, but again the method would be most useful when used in comparing areas with similarities. Most societies in the savannahs have age-sex classifications which can be used in rapid surveys to build up population pyramids and sex ratios. This was done during preliminary work in Tenga (Kusaok) and produced results very similar to that obtained later by using much more accurate methods of determining age.

In overpopulated areas like Kusaok, increased labor not only adds increasingly small increments to production, but absolute production is falling, so that food availability per person also diminishes. In such situations either massive subsidy of the population with food, inputs, medical care, and credit is required, until the degradation of land can be halted and reversed and the physical condition of the population restored, or resettlement has to be undertaken. Both types of solutions have been and are proposed for northern Ghana and the results and future prospects analyzed.

In areas where the system can still absorb and adequately nourish increasing numbers of people and livestock the problem of increasing labor input per unit of land becomes one of improving the quality of the labor and the amount devoted to agriculture. Quality is improved primarily by decreasing disease through public

health programs, which must, of course, be integrated with the agricultural development. A long term goal may be to decrease the dependency ratio so that a larger proportion of the work force is putting in highest quality labor. This means decreasing birth rates at the same time that disease prevention will be decreasing death rates. Increased survival means that a great deal less time will be lost to pregnancy, lactation, and child care for children who never grow old enough to contribute to food production on the family farm.

Making more labor available to agricultural production is approached in two ways: spreading out the labor requirements of the year (see section below on economics), and decreasing time spent in subsidiary tasks (grinding mills to replace stones, e.g.) or increasing efficiency of time spent in agricultural tasks (plow replaces hoe).

Increasing opportunities for cash income through wage earning opportunities or crop markets will increase the ability to purchase some of these technological items that can increase the quality and quantity of labor available for intensification.

Attempts to increase production based on periods of unusually favorable environmental conditions can lead to increased population and areas cultivated so that when poorer conditions return there is real disaster. Such

appears to have been the case during the current dourght in the savannah. It is necessary for planners to consider as much information as is available on long term trends in precipitation, ground water and surface water availability when planning for intensification, since such plans must always be linked directly with water supply.

If water supply is to be made more reliable by the building of dams and reservoirs or the use of irrigation ditches and flooding of fields, then the likely possibility of increase in water-borne diseases should be understood, and provisions made in development plans to prevent it.

Large scale schemes at controlling the environment are inevitably dependent on the efficiency of an administrating and technical organization. Problems in the Office du Niger project, and the failure of the large scale mechanized farming program in Nkrumah's Ghana show how easy it is to overextend administrative and technical capabilities to end with negative results. The possibility of small scale, long term programs of soil and water conservation should be considered, perhaps based on techniques already in use locally. In the Kusasi area, for instance, this could include the planting and nurturing of trees by farmers on their own fields, contour terracing, use of grassed run-off areas, and well irrigation.

Increased land use, whether by decreasing fallow, increasing labor input per unit of land or increasing mechanization increases the vulnerability of soil and vegetation to degradation. Whenever intensification is considered, it must be remembered that since more is being taken out of the soil, and it is being left for increased amounts of time without vegetative cover, provisions for protection and replenishment must be made. Failure to do this in the valley rice production in northern Ghana has led to widespread deterioration of land resources.

Intensification programs often emphasize the increased production of cash crops, and this can have adverse effects on nutritional status, as these crops begin to compete for food crops with the available land, labor, and capital input. Cheap, high calorie, low nutritive value crops and products (e. g. cassava) tend to be substituted in the diet for more nutritious indigenous crops like sorghum and millet. Nutritional status can suffer and decrease the effectiveness of labor input (Haswell 1975). There is some indication of this in the Office du Niger development project in Mali (M.I.S.E.S. 1961a).

Any program aimed at increasing intensity of agriculture and thereby hopefully production per person, also

has the potential of increasing local population by attracting immigrants, decreasing death rates (as nutritional status improves and money available for medical care increases), and perhaps of increasing fertility rates as well. With annual growth rates of about 2.5 per cent (implying population doubling rates of around 30 years) increases in production may soon be swallowed up by increasing demand for local consumption. It is imperative, therefore, that any program of intensifying agriculture include a component to monitor population growth and its components, and to incorporate an intensive family planning program in conjunction with the medical and public health programs. The same problem is faced by resettlement schemes, since the reduction in population densities may act as a spur for increased population growth. Since numbers removed will be so quickly replaced by natural increase, resettlement alone will never be the answer.

Rather than specifying what kinds of indigenous systems must be present or which types of technology should be introduced to move agriculture in the direction of intensification, we want to discuss the tendency of these methods to either expand or contract the range of options available to the individual farmer. Our contention is that every smallholder in some sense negotiates a compromise among his resources of land, labor, and

capital and the needs of his household over time. No expert can say unequivocably that a new method will work to the advantage of a particular farmer, but if it increases income without seriously undermining traditional production or increasing risk, there is little doubt that farmers will try it out. Technology that is additive rather than substitutive, such as improved seeds for familiar crops or chemical fertilizer for mixing with compound sweepings, can be integrated easily and gradually into a cropping system. Where the benefits are obvious, as they may well be where the fertility of an infield is declining, farmers may decide to adopt them. Whether such inputs are used for cash or food crops and what levels of application are needed on different soils are problems perhaps best left to the cultivator. The kind of effort required for intensive agriculture is largely voluntary, and methods that restrict the choices available to the farmer or force him to neglect food in favor of market crops may be seen as unwelcome or even dangerous constraints. The value of an expanding infrastructure is that it gives the farmer the chance to produce for the market without coercing him to do so or deciding how much of his time should go into such activities. Price incentives may elicit both increased supplies of some commodity and, indirectly, the intensive techniques by

which it is most effectively produced (e.g. the local market demand for sugar cane leading Hausa farmers to put more time into fadama). Such development may be slower than that of planned projects, but it grows on a more solid base and brings the kind of change to rural populations that benefits them directly.

Though we have refused to identify intensification with a reliance on modern, high-energy machinery, we think the possibilities for intermediate technology in furthering this process are quite good. Again, African cultivators can show us the way. There has been a striking growth in the use of plows and animal traction in many savannah areas from Senegal to Nigeria. So-called mixed farming with increased yields due to the plow's thorough turning of the soil and the provision of additional manure has also given the farmer a source of cash in his mature draft animals and the ability to transport loads over longer distances. If some of the plots are too small, irregular or hilly (as in the area around Kano and in northeast Ghana), or long fallowed, the advantages of animal plowing may be less. The initial investment in buying and training oxen may also be too high for most farmers. But experience in northern Benin has shown that when people supply their own animals and

are given access to standardized, locally repairable equipment, the technology diffuses rapidly (Eicher et al. 1976). To avoid the indebtedness and frequent defaults hampering many such schemes, one year trials were allowed, after which a farmer could either drop his participation with no further costs or commit himself to purchasing the equipment over the next five years. Other farmers can hire the service of a plow and team, and the plow owners benefit both by better tilling of their own fields and a cash income to repay their capital costs. Where cultivation is limited by seasonal needs for rain or irrigation, the plow may substitute for limited labor, and this advantage has been recognized by many of the rice farmers of the Niger inland delta and many rain-fed farmers in Kusaok.

The contrast between introduced technology widening and restricting farmers' economic options is clearly visible in projects on the Senegal River in Senegal. Though all have the aim of promoting irrigated rice production with a second dry season crop, the capital intensive developments with diesel powered pumps, miles of canals, and heavy reliance on tractors often demand resettlement of workers, rigid scheduling of labor, and sales of produce to government agencies to which the farmers may also be indebted. In the area of Matam, however, Toukoulor farmers

are offered the services of simple mechanical pumps mounted on rafts if they will clear, level, and ditch irrigable land. Gas for the pump engine and a fund for replacing it are also responsibilities of the farmers and must be paid for in cash. Wet rice has been merely added to a local agricultural inventory already including flood recession gardens, upland millet fields, livestock, and fishing. Farmers choose to become members of an irrigation group and then decide among themselves how the necessary labor and capital will be invested. The produce is consumed or sold through local market channels. Decisions as to whether the rice crop should be followed by corn, wheat, or tomatoes are made by the farmers themselves. Both the investment in equipment and in expatriate staff for the project is kept low, and its substantial growth in recent years can be traced directly to individual profitability. For local cultivators, irrigated rice represents diversification rather than specialization, and it provides another means for limiting the ever-present risk of drought. Agricultural intensification on a small scale is an obvious strategy which need not interfere with tested subsistence techniques that continue to be practiced. It is true that such a project may require per capita increases in labor and the addition of arduous

tasks such as transplanting, but as we have indicated, the most feasible route to intensification involves higher labor inputs. African farmers do not seem reluctant to make such contributions as long as they have some control over the conditions of their work and as long as the rewards are commensurate with their increased efforts.

A failure to change agriculture is often credited by both developer and farmer to cultural impediments, but, in fact, groups from many different backgrounds have engaged in it. In the same circumstances, pagans and Moslems, town dwellers and countrymen, native and migrant groups, and almost any ethnic type (including settled Fulani herders) have taken up some form of intensive agriculture. Though nuclear family household organization and more individualized land tenure may show a statistical relationship to highly intensive system, there is nothing to indicate that they are prior requirements for a change of this kind to take place. Indeed it seems to us that alterations in family form, marriage patterns, lineage or class institutions, and land tenure emerge gradually as a response to the labor requirements and economic strategies that accompany intensification. Customs that deny continuing rights in property to someone who has improved that property or that prevent the farmer

from enjoying the fruits of increased production would certainly delay intensification, but these are less likely to arise from local cultural values than from the manipulations of regional or national governments. The rights of migrants to cultivate intensively on fallow land belonging to an indigenous group may certainly become a matter of dispute, but if environmental and economic conditions are favorable, it is unlikely that the process will be long delayed.

In attempting to estimate which sections of a community will accept innovative technology and increase their production, "common sense" may not be a particularly good guide. Though one would expect older farmers to be more tradition-bound whereas younger men would more quickly appreciate improved methods, studies among Hausa showed that age was not significantly correlated with acceptance of change (Tiffen 1973). Social class may influence movement into the market economy but not in any simple way.

Cancian (1972) discussed the relationship between social position within the community, and willingness to adopt government innovations (improved roads, and establishment of government receiving centers for agricultural crops), in a small, Maya village in lowland Mexico. He felt that two factors related to social position would govern willingness to innovate: first, those with relatively

greater status (and relatively greater wealth) will be more able to marshal the productive inputs necessary for innovation, but also, that a sort of "middle-class conservatism" makes people of middle social status more risk-aversive than either high-status or low-status persons. His results showed that initially those of middle rank were, indeed, reluctant to adopt innovations, but that with time, they became more willing to participate. DeWalt's (1975) field studies in a community near Mexico City confirmed, for the most part, those of Cancian, but he stressed the necessity to consider investment and opportunity costs for each innovation separately.

In the beginning of this paper, we gave three definitions for intensification, and this section will deal with the third of them, where intensification is viewed as "increasing yields by raising inputs of energy (principally labor) on a fixed area of land." From this perspective, intensification means a change in the farmer's allocation of productive resources. The case studies have discussed some of the factors which enter into farmers' decision-making in specific situations. The case studies also stressed the need for planners to understand the farmers' production constraints when

proposing changes in agricultural techniques and cited examples (e.g. rice transplantation in the Office du Niger) where these constraints had not been fully taken into account. It remains, however, to suggest how the planner might best get information on the allocation of resources in farming, in a field situation where time and resources are limited, to discuss the state of our knowledge about how subsistence farmers make production decisions, and how they will respond to suggestions for innovations. The case studies described instances where factors like changes in prices paid to producers, risk from change in flooding levels or rainfall, and transport difficulties have affected allocation of resources in production. This section will generalize on the effects of these, bringing in literature from other parts of West Africa, and from outside regions, and will discuss the implications for policy-making.

Cleave (1974), Upton (1973), Clark and Haswell (1970), and Collinson (1972) summarize much of the recent work on agricultural production in smallholder farms in West Africa, and all treat allocation of labor in detail. In general, the relatively short period where rainfall is available means that agricultural work must be compressed

into relatively few months (Cleave 1974:120 gives data on month-by-month inputs from 22 studies). Moreover, the productivity of labor will vary during the agricultural season (Upton 1973). The peak period of labor input tends to be at weeding, in the middle of the wet season (ibid:123). We have seen that weeding has seldom been successfully mechanized, and, indeed, that the use of ox-drawn plows for land clearing often increases the need for weeding later in the season. Where, as is common, several crops having different labor requirements, are grown, scheduling becomes complex, and opportunity costs (i.e., the product foregone by a particular allocation of labor) of decisions must also be reckoned (Upton 1973:144).

Traditional responses to labor constraints can run counter to "technically optimum" scheduling of tasks. For example, staggered planting spreads work requirements, but reduces overall yields (ibid:134). Crop substitution (e.g. cassava or plantain crops for grain crops) also reduces seasonal demands for labor. Manure application may make cultivation easier but necessitate an extra weeding with its demands for scarce labor. Suggestions for easing peak demand for labor have included: planting in rows (permitting ox-drawn cultivation) and the use of herbicides. Indeed, Norman (cited in Cleaves 1974:140) felt that the

return to weeding in Zaria, Nigeria, was high enough that use of herbicides was economic even on small, traditional plots. In sum, suggestions for increased labor intensity in farming must try to avoid periods of peak labor demand and, where possible, should seek to equalize labor requirements over a long period. Efforts at technical innovation will also be most effective where they relieve a real stress in the system.

Data on labor needs are an obvious necessity for effective agricultural planning, but gathering such data can be costly in terms of time and of expense, if traditional ethnographic methods of participant observation are used in a small community. Standard procedures for getting farm management data include the cost-route method, where producers are interviewed regularly throughout the growing season (Spencer 1972), and single-visit farm business surveys (Collinson 1972). Comparing multiple-visit and single-visit surveys, Collinson (1972:229) noted that the latter method drew on the farmer's experience over a number of years, rather than on specific rates for a particular season. He felt that African farmers were likely to be used to estimating labor needs for various tasks -- since labor needs so often constrained production -- but that they were not likely to be able to

express their estimates in terms of formal measures (e.g. man-hours) without help, and he furnishes detailed suggestions for survey procedures to make precise farmers' estimates of man-days needed for particular tasks, crop, field, and so on. Comparing costs of single-visit and multiple-visit survey coverage, per area covered, Collinson (1973:307) found that the former were far the less expensive. A possible strategy for preliminary agricultural planning might start with single-visit surveys, aimed at getting the broad outline of the local agricultural system and at asking farmers' opinions on how feasible specific innovations would be, and whether they, personally, would find specific techniques acceptable. Where necessary, cost-route methods could later supplement preliminary work, for example, in comparing labor inputs and yields for farmers participating in pilot extension programs, with those of farmers in the community as a whole.

Several general constraints for increasing labor inputs to agriculture have been discussed in the economic literature, and one of the most commonly mentioned is the "backward sloping supply curve of effort" -- the idea that farmers do not always respond to economic incentives, that they do not always work harder when marginal product for labor increases, or when wages rise, because

of an inordinately strong preference for leisure. The implication has often been that peasant cultivators are economically irrational. Several authors summarize the available data on this problem, but none so succinctly as Upton (1973). "This, of course, is nonsense. In every society in the world people value their leisure and will not work all the hours that are physically possible in order to earn more." Clark and Haswell (1970:140), treating the backward sloping supply curve of labor noted:

> "This idea has aroused a great deal of interest, but facts in support of it are few. Both theory and empirical study indicate that such a state of affairs is not likely to be found in any community with reasonable contacts with the rest of the world, where men can seek alternative employment, and where a wide range of commodities is on sale."

They felt that the reasons African farmers produced relatively little were poor transport and problems in marketing organization. Dean (1965), investigating the supply respon to price change in Malawi, for tobacco growers, similarly found no evidence for a backbending supply curve for labor.

Discussing agricultural wages, Clark and Haswell (1976) noted that they were, of course, related to marginal product of labor. Worldwide, they found that agricultural wages (for local laborers) showed a minimum of 3 kg grain equivalent per day; that, at rates lower than that, workers seemed almost always to prefer leisure to work.

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Another factor which was shown to limit farmers' willingness to intensify was their uncertainty about environmental conditions like rainfall and flood levels as well as about prices for agricultural products. Because the odds on different environmental conditions cannot be quantified, because farmers cannot estimate these probabilities, some say that farmers' inability to predict is better called "uncertainty" than "risk" (Cancian 1972:6, Calavan 1974:229). Others, however, (e.g. Upton 1973:91) feel that the distinction becomes blurred in practice.

The case studies discussed some of the responses of traditional farming to these risks, including: diversification (engaging in non-farming activities as well as crop diversification), staggered planting, use of drought and insect-resistant crop varieties, and planting fields in different micro-environmental conditions. Many of these adaptations, of course, are achieved at the cost of less than maximal yields during some years. Examples from Mali showed that planners did not always realize the full possible range of variation in environmental conditions, and quantitative data gathered over only a short period cannot fully apprise them of it. The classic examples of failure to see the range of possible changes come from the literature on the recent drought years.

Where technical innovations are being introduced into traditional farming areas, producers are faced with new uncertainties. Several recent ethnographic studies from outside Africa have tried to elucidate how farmers make decisions under these circumstances: a study of cultivators of irrigated rice in a village (where external environmental variation is less than in the Sahel) in Thailand found (Calavan 1974:128) that:

> "Sansai decision makers operate under the constant constraint of incomplete information. They must choose crops, varieties, and techniques without a full inventory of possible payoffs. Long-established strategies may provide nearly complete information, but promise lower payoffs than newer strategies for which less information exists... Farmers clearly regard each crop, each year's planting pattern as an experiment, to be altered without compunction if some other appears to be superior."

Calavan examined the pattern of acceptance of one innovation -- a higher yielding rice variety introduced by agricultural extension agents -- in detail, and derived a model for the decision making underlying the observed pattern of crop choice by these farmers. He felt that the farmers observed the experiences of a random sample of their acquaintances with both old and new rice varieties on their own lands, and chose the higher value. The model correctly predicted a major shift in crop choice: while only a small minority (10%) used the new variety in the first year after

introduction, a substantial majority (66% to 90%) of households planned to adopt it during the second season (ibid:258). The model can be generalized to cover a longer time span. Calavan's model of decision-making has implications for government policy: if farmers indeed made choices more or less as statisticians do, then the principal effort of agricultural extension services should be to educate them to assess the range of available technical options. In addition, it is important that government agents attain a "critical density in the dissemination of new techniques and varieties. If only a few cases are available from which farmers can sample, then their judgments cannot be as reliable as when a larger sample size is available."

Experience in the Sahel has shown that farmers are more willing to increase inputs to agricultural production, in cases where risk of crop failure can be reduced. Thus, farmers in the inland delta (Mali) were more willing to use fertilizer on irrigated fields within the Office du Niger, than on fields with only partial water control. Similarly, Hausa farmers in Niger (Raynaut 1975:27) showed themselves unwilling to use chemical fertilizer on rainfall-dependent fields, but use it regularly on fadama (low-lying fields) and in well-irrigated gardens.

Another sort of risk, of course, is that of fluctuations in world commodity prices. Haswell (1975:79f) describes one instance of the dislocation caused by such price changes: in the Gambia, producer prices for groundnuts had been raised substantially in 1951 - 1952 (to bring them into line with world market prices), but world prices fell sharply the next year, and producer prices had to be reduced accordingly. Farmers, who had been granted advances based on 1951 - 1952 prices found themselves unable to pay debts; and purchasing firms found themselves unable to extend further credit. Impact on purchasing power in farming villages was great, and one result was to encourage stock-raising by farmers, as a buffer against risk of dramatic price declines (ibid:174).

Where a failure to balance food and money income with subsistence needs in any one year may mean hunger, farmers are understandably more concerned with limiting the standard deviation of their yields than in maximizing production. In trying to assess the effect of risk of farmers' willingness to intensify and to innovate, planners should try to combine long-term data on fluctuations in product prices, in rainfall, insect damage, and so on, with interviews of producers in target regions. These interviews could productively be combined with farm-business

management surveys, and should try to ascertain what have been causes for crop failure and financial loss in the farmer's experience, which are the risks he takes into consideration when making production decisions, and also how these risks might be lessened.

A third factor which limits intensification of agriculture is transport -- both transport from producing areas to market, and the daily back-and-forth transport of the workforce to the fields. One of the first efforts to model the interrelationships of transport and the intensity of agriculture was Von Thunen (1966). Clark and Haswell (1970:191f) give a more recent summary of transport costs as they affect agriculture:

> "It cannot be emphasized too strongly that the first requisite for the improvement of the production of a subsistence economy is the provision of transport. Fertilizers, improved strains of seed, education and other objects are all of the greatest importance. But the need for transport is prior to all these. It follows from the nature of the case. If there is to be any improvement in an agriculture which at present only provides for subsistence, crops must be grown which can be sold. Selling implies transport to market. The methods of transport available to subsistence agricultural populations, as will be seen below, are so costly that produce only has to be carried a limited distance before most of its value, from the point of net returns from the sale, has gone."

Although some areas have adequate primary road networks, feeder roads are often nonexistent, or usable during only

part of the year (e.g. Steedman et al. 1976:53). Where the feeder system is inadequate, villages more than 5 km away from all-weather highways find themselves isolated (Haswell 1975:217). Costs of transport have been shown to affect the possibility of seasonal labor migration as a source of supplemental income (Beals et al. 1967).

Transport costs also underlie the sort of gradation of cultivation intensity around settlements. Cleave (1974:35 summarizes available data on time spent by farmers walking back and forth to the fields as a percentage of total annual labor input which ranged from 10 to 12% (in Genieri, Gambia, 1953) to 34 to 46% (Nupe villages of northern Nigeria, 1954). Improvements in transport between village and field can profoundly alter the pattern of agricultural production (e.g. Cancian 1972). A classic African example is the village of Genieri, in the Gambia, where a causeway had been constructed in the 1950s, which made river flats more accessible for wet-rice cultivation (Haswell 1975:115f)

Swamp rice cultivation, using transplanting, was traditionally carried out by women, and, relative to less labor-intensive upland cultivation of millet and sorghum, it increased greatly in importance with construction of the causeway. During the time after the construction of the causeway, the sexual division of labor began to alter,

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with men helping women at production bottlenecks. Construction of the causeway permitted cultivation nearer to the edge of the mangrove swamps, where yields were higher, without change in production techniques. Thus per capita subsistence crop production, expressed in paddy equivalents, rose by 30% after construction of the causeway.

The case studies noted that intensification of agricultural production was only one of a number of options for increasing communities' food supply -- labor migration, commerce, crafts, are among the possible alternatives to agriculture. Smith (1975) presented a scheme which related population density, location with respect to markets, and transport for western Guatemala. The relative productivity of labor in various rural, non-agricultural occupations has been debated. In very high-risk agriculture, like that of the Hausa of Niger (Reynaut 1975:30), commerce may often be a more productive use of labor than subsistence agriculture.

The effects of colonialism, explosive urban growth, and government fostered unequal development may mean that even menial jobs in the modern economy may pay better than farming. Certainly the Kusasi who migrate from northeastern

Ghana see no material advantage to remaining in agriculture. More productive intensive systems in more highly integrated economies may alter this balance. Recent data from rural Java showed that rural owner-cultivators had substantially higher returns than agricultural and other wage laborers, craftsmen, small traders, and herders in that order (Nag, White, Peet 1978). As long as farmers have adequate land and can market their surpluses profitably, they find this occupation more financially advantageous than the other employments open to them.

Impressive local examples have shown that agricultural intensification has taken place with indigenous crops and tools in the West African savannahs, that it is continuing, and that intermediate technology is being adopted in this process. It is equally plain that the lack of water and the presence of certain soils may restrict intensification to certain areas with better rainfall, seasonal flooding, or the potential for irrigation. Whether this possibility is achieved will depend on the factors of population push and economic pull. The competition for land that makes permanent cultivation necessary and the attraction of marketing surplus production combine to make more intensive farming a logical, indeed almost

inevitable, development. The cost to the African smallholder is usually increased labor input, and he is likely to make this investment only if he finds it profitable as compared to other uses of his time. The best indicator of where and in what agricultural sectors intensification is feasible are the trends already visible in local land use, cash cropping, land tenure, road traffic, marketing, and personal income. The variety and vitality of such efforts suggests a flexible, localized strategy for cultivating intensification where it is already growing instead of transplanting a standardized Western model to an alien ecosystem.

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V. DEVELOPMENT FOR WHOM?

Abraham S. Waldstein

The author spent a year and a half in Senegal doing field research in the Delta perimeter of SAED, the Senegalese government agency charged with intensive hydro-agricultural development of the Senegal River Valley, revisiting Senegal three times. In the role of consultant, the author has had the opportunity to pursue his first-hand acquaintance with irrigation projects in the Senegal River Basin throughout the region.

Introduction

Large-scale projects requiring the infusion of large amounts of capital have been the focus of the operations of institutions responsible for promoting development in Africa for three quarters of a century. 230 such large-scale projects,[1] either completed or undergoing realization, have been identified including 31 large-scale agricultural intensification projects in the Sahel and several projects have been overlooked.

Many schemes have failed and many other have been only partially successful, irrigation schemes in particular, due

mainly to their high cost of management and overhead. The economic requirements of all projects structure the social circumstances and affect the material security of the project adherents.

The question of "Development for Whom?" is the fundamental problem, and in order to shed light on the distribution of benefits from large-scale agricultural intensification projects in the Sahel, several will be discussed, with the concern that, by the very nature of the projects, the beneficiaries cannot be the "poorest of the poor." While the project adherent may draw some material benefit from participation in the project, the chief beneficiaries have consistently been at the level of national or international management institutions.

Development for the rural cultivator should mean increased access to the resources that reinforce his material security and that of his family which can be identified in the areas of diet, health care, clothing, shelter, consumer goods, and in a pledge for the welfare of the succeeding generation manifest through access to a secular education. Achievement of this reinforcement of material security can occur only with the broadening of the beneficiary's options for meeting his material needs and participation in a project should be a choice freely made from among several options.

A project which limits rather than extends options risks impoverishing the adherents at the same time that it pretends to enrich them. In principle, the project must be congenial to the beneficiary's interests or he will not take part in its operation or to take part in a way that prejudices its success.

A major objective indicator of whether the project has achieved its development goals is the stability of the participating population within its confines. Population instability and migration have been significant phenomena throughout the course of Sahelian history, and took on new prominence as the colonial regimes of the early 20th century began to remold Sahelian socio-economic life in light of the needs of the global economic system. But large-scale migration is disruptive of family life and authority structures, and sometimes, agricultural productivity in the home localities of the migrants. A successful development project will shelter a man and his family throughout his economic lifetime and will provide a livelihood for his children who will, in turn, remain within the project for the duration of their productive lifetimes.

Population stability, however, should not deflect the attention of project planners from other more abstract measures of a project's success. To say that the adherents

are satisfied with their participation in the project as indicated by the permanence of their residence does not address the question of equity. Furthermore, if the project, indeed, adresses itself to increasing the well-being of the "poorest of the poor", it must be organized to safeguard the adherent's interests. This objective forecloses certain approaches while it warrants others.

Social Objectives of Government Programs

Agricultural intensification in the Sahel has been pursued on such a large scale that national and international institutions have been drawn into its development, because projects have not been possible without external intervention. Local interests, therefore, have had to subordinate themselves to those of the institutions underwriting development.

For three decades the Senegal River Valley has been the spawning ground for a series of agricultural intensification projects concentrating on the production of rice in irrigated perimeters. The primary objectives for this development have consistently been on the national level. The law creating SAED in 1965,[2] for example, endowed the newly formed organization with three objectives:

1. To improve, people, and exploit the works on the improved Delta lands.

2. To process and market produce from the improved land.

3. To organize the newly settled peasantry into cooperatives for development.

Papa Syr Diagne, until recently the Secretary-General of SAED, has reiterated these objectives in print on several occasions.[3]

The projects in the Senegal River Valley have all focused on rice production to meet the growing internal demand for rice as a food staple. The colonial authorities, shaken by the food deficits so apparent during World War II, especially in the urban areas, created the irrigated perimeters in Richard Toll to reduce Senegal's reliance on imported rice to feed its people. The Richard Toll schemes collapsed in 1971 after the project had absorbed an investment of over $13.5 million,[4] because the rice produced at Richard Toll was never able to compete with rice imported from South-East Asia. White rice left the mill at Richard Toll at 20 3/4 cents per kilogram from 1967 to 1971 while during the same period, it could be landed in Dakar for 13 to 16 cents per kilogram.[5]

Productivity was never high enough. Between 1956 and 1959 Richard Toll averaged 0.30 metric tons of paddy per hectare during the rainy season and dropped by the 1966 to 1969 period to 0.23 metric tons of paddy during the rainy season. The only year the management tried off-season

cultivation, 1967-68, the average yield for the off-season was 0.40 metric tons of paddy per hectare.[6] The management was also unable to utilize all 6,000 hectares it had improved let alone to justify further improvement to meet its goal of 55,000 hectares.

The project had serious technical problems that presently confront other large-scale agricultural intensification projects in the Sahel. The Senegal River Valley, being on the periphery of the global economy, must import all capital equipment as well as the expertise to use and maintain it. This makes capital investment more expensive and, the proper execution of the works it has been imported to underwrite, all the more problematical. The land, in fact, was often poorly graded, the construction equipment poorly maintained, planting and other cultivation activities poorly coordinated, and canals and drains poorly cleared.

Production at Richard Toll, under the state farm system, was managed for the state by agencies of the government or private firms responsible to the government under contract. Hands in varied numbers were hired at a low daily wage rate to execute field operations that could not be accomplished by machine, such as seeding, weeding and harvesting. Thus, the population of Richard Toll soared as prospective hands descended on the town in the hope of seasonal work and,

since most of the hands were hired for short-term work according to the season, they were never able to reach their most productive level by adapting to the requirements of mechanized rice production.

Perhaps a more lasting social legacy of the rice perimeters in Richard Toll, rather than the creation of this ephemeral working class, has been the creation, at the fringe of the project, of a small village of irrigated rice cultivators. Large-scale agricultural intensification projects run the risk of becoming enclaves of agro-industrial production methods having little interchange with the range of subsistence methods practiced around them. This is especially the case for irrigation projects which require capital investment for development and operation far out of reach of even the most ambitious rural cultivator. The Richard Toll Colony is one of the rare cases of a spontaneous attempt by rural cultivators to recreate the operations of a large-scale agricultural intensification project on a village scale under their own direction.

An association of cultivators in the Richard Toll region obtained the right to cultivate about 400 hectares just southwest of the main project in December 1956. The association created a colony near its fields whose membership for the last 20 years has remained in the neighborhood of 110 heads of families.[7]

The colonists were not in a position to acquire the machinery to cultivate their fields according to the Richard Toll model as it was far too expensive for them. Neither could they design and construct the irrigation works themselves as they did not have the experience or the material. Rather, they depended on the management of the Richard Toll plantation to create the works, hiring the machine services from the plantation and clearing their debt by reimbursing the plantation in kind at a given rate per service after harvest. The productivity has, however, been consistently so low that they have required a large subsidy simply to continue cultivation there. As Maiga points out:

> "The yield per hectare is too low, not permitting a growth in production and the colonist would only assure the conditions of his subsistence if he had to pay the exploitation charges at their real value in a colony where $2,300 was invested per hectare (on the average) in the hydroagricultural infrastructure."[8]

Nonetheless, the cultivator's reliance on the plantation (or since the plantation's demise, on SAED which currently oversees operation in the colony) for machine services reduced the requirements of his own labor to no more than 60 days per year, obliging him to leave the colony during a large part of the year to search for income opportunities elsewhere. The rate of absenteeism in the colony has been

very high as colonists have hesitated to move into the colony definitively and retain ties with their villages of origin. Further, no provision has been made in the colony for a market, a dispensary, schools or even a sanitary water supply.

Richard Toll colony is a forerunner of SAED's development activities in the Senegal River Delta and SAED has been the vehicle for translating the objectives of the Richard Toll irrigation scheme into a post-independence idiom. It has also added a dimension to the Richard Toll scheme, a consideration of the interests of the people most immediately concerned by the project. Although the social intent of SAED does not appear in the legislation creating the organization, it does appear in subsequent discussions. Minelph Diallo, writing under the aegis of SAED in 1975, expressed it this way, "The first objective assigned to the regional development societies such as SAED is to slow down this movement of rural population toward the cities by developing the national regions."[9]

SAED promotes its social objectives by organizing rice production on a cooperative basis, by increasing the average incomes of the cultivators who choose to participate in its program, and by stemming the tide of rural-urban migration by providing adequate access to resources through work

opportunities in a rural setting. When it was created in 1965, SAED's role was restricted to the agricultural development of the Senegal River Delta. At that time the Delta was sparsely inhabited, sheltering only one permanent agricultural settlement and otherwise inhabited by members of several fractions of transhumant pastoralists and half a dozen fishing villages. Furthermore, the Delta was out of the grasp of local cultivation technology as it was prey to a post-rainy season river crest which, during October and November, inundated it in exceptional flood years. The retreat of the high waters by January also left the Delta subject to salt water infiltration especially at high tide.

SAED treated the Delta as a virgin frontier, built its projects, displaced the local herders and settled close to 6,000 colonists in the area by 1970 who, as members of a cooperative, cultivate in the SAED perimeters in a sort of tenancy relationship with SAED. Each tenant is attributed a share of the land according to the size of his family, and obliged to cultivate rice only during the rainy season. He may choose to grow tomatoes or pursue other interests as he pleases during the off-season. Like the colonists in Richard Toll colony, the tenants owe SAED a reimbursement in kind for materials and services used for cultivation. Unfortunately productivity in the Delta has been so low and

debts so high that, in effect, SAED Delta projects betray SAED's social objectives and encourage migration rather than reduce it.[10]

Productivity in the Delta has also been severely limited by the high salinity of the soils. Moreover, the drought years of the early 1970's challenged the efficiency of SAED irrigation works; therefore, between 1968 and 1972, SAED was forced to increase the level of technical refinment of its works to "complete mastery of water." The costs of developing the most-refined level of works has been estimated at a little over $5,100 per hectare at 1977 prices.[11]

Since 1974 SAED's mandate has been extended to pursue hydro-agricultural development throughout the Senegal River Valley although, in most cases SAED's interest has remained in large-scale operations whose primary objective is to produce large quantities of rice to feed the urban markets and reduce the foreign exchange loss accompanying large-scale rice imports. SAED would like to see incomes throughout the river valley raised to the point that migration out of the area would diminish, but this objective is of secondary importance and must cede precedence to rice production whenever there is a conflict.

The Office du Niger oversees cultivation on about 55,000 hectares in the interior Delta of the Niger River in

Mali.[12] The project was envisioned in the 1920's for rice production and, prior to 1969, the cultivation of cotton for market consumption. Its social intent was to resettle one million people from over-crowded, impoverished areas (principally from the Yatenga and Ouahigouya Mossi Kingdoms of Upper Volta) to work the more promising irrigated perimeters of the Delta on 2.5 million acres of improved land.[13] However, in neither its commercial nor social aspects has the project achieved the results expected of it. Moreover, it has consistently had difficulties reconciling the interests of the tenants to the financial responsibilities of the Office du Niger administration.

Development began on a modest scale in the area in the mid-1920's. In 1932 the Office du Niger was created by the colonial government to give an organizational framework to the small projects already underway in Niele Bale, Baguineda, Kokry, and Nioro and, to extend development throughout the area. The labor requirements in the earlier projects were low enough to be satisfied by local residents but as the scale of operations expanded, it became Office du Niger policy to conscript families from Upper Volta and to transplant them for work in the interior delta projects. Hammond estimates that 5,000 persons from the Yatenga Kingdom alone, were moved into this area.[14]

This policy of labor conscription proved to be of no particular benefit to the project and had traumatic social consequences for the families involved. During the 1960's, the Mossi left the project in large numbers because they were unwilling to cut ties with their homeland, important to their well-being, and management had not understood the ties. The communities in which they were placed by the authorities did not have the security of those in the Mossi homeland where lineage relations had matured over generations and people were confident not only in their relations with each other, but also in village authority. In the new setting, laborers coming from different parts of the Mossi territory were housed in the same village as though they were kinsmen and chiefs were chosen because of their cooperation with the Office du Niger administration.[15] Hammond summarizes, "Isolated from their kinsmen and the protection of their ancestral spirits, the colonists miss the emotional and social satisfactions of extended family living as well as the security of an established position."[16]

The project had settled 20,000 people by 1945. Each family is assigned a plot of 1.5 hectares per family member on a tenancy basis and the tenant signs a contract binding him to respect company authority in all areas of production technique, schedule of operations and maintenance of the

assigned property. After ten years of satisfactory completion of his responsibilities, the tenant achieves the right of permanent occupation approaching ownership. The tenant owes annual dues equivalent to 400 kilograms of paddy rice per hectare to the management which are in exchange for the extension services and materials supplied by the Office du Niger. Originally the project relied less on mechanical cultivation than on intensive training in "European-improved African traditional" methods through an extension service dominated by European technicians.[17] The tenant also has the right to do vegetable gardening or millet cultivation, debt free, on plots set aside for that purpose by the administration.

Productivity in the Office du Niger has always been low, especially before the completion in 1948 of the dam in Sansanding, which gave the project more control over access and distribution of water. Low productivity has also led to another nagging problem, a shortage of labor, which propelled the project into a quagmire from which only the recent drought seems to have extricated it. As it became clear, that a long-term shortage of labor would hamper exploitation of the tenancy system in the full area developed in the Delta, the Office du Niger converted several zones into state farms, as in the Richard Toll system, machine cultivated

area in Sudan, while producing 75 percent of the country's long stable cotton.[24]

The main objective in creating the Gezira Scheme, as with the two projects previously discussed, has been relevant more to institutional needs outside the zone than to the needs of the participants in the project. It was the preference of the colonial powers, Great Britain in the case of Sudan, to generate the expenses of occupation and administration from the local economy; meanwhile, the textile mills in Lancashire were looking for a source of raw cotton which would be more dependable than their customary American and Egyptian sources. Thus, the interests of the colonial government in the Sudan and of the Lancashire entrepreneurs converged to promote a cotton growing scheme at Gezira.

The social objectives at Gezira were limited for many years only to protecting people from the ravages of famine, which was assured not only by giving the tenant a modest cash return on his cotton production but also by allocating him an irrigated lot on which he could cultivate grain staples, debt free, to meet his family's food needs. The interest of the tenant, however, is in his grain crop and, in times of water shortage, he sacrifices his cotton to benefit his food.

> "The tenants' financial position is precarious and they do not consider that they receive an adequate return from their cotton. The dura, by contrast, will always be a stand-by, whether for food or for credit."[25]

Nationalism began to rise in the Sudan during the 1930's and 1940's and pressure built against the private managers that held the government contract to manage the Scheme, in order to have them make concessions to the tenants in the name of devolution or local autonomy. Social development became an official part of Gezira objectives only after nationalization in 1950 but devolution has still not gone very far. "Throughout the history of the Scheme the devolutional policy has had to take a back seat to the demands of the economic goal."[26]

The tenant's role is more that of a wage worker than that of a peasant and his only responsibility is to supply labor for production. His area of decision is restricted to the composition of that labor, how much of his own, how much of his family members and how much from migrant laborers hired by the day. Although the Gezira project is often judged a success, its dependence on the large migrant labor force must be kept in mind as the presence of this large unstable work force is an indication of the secondary importance of the social objectives of the scheme.

The primary goal of every large-scale project is the realization of a policy formulated by national or international institutions. During the colonial era, the economic objective was the production of some primary product to supply the home markets of the imperial power. So it was, that the Gezira Scheme and the Zande Scheme,[27] both in Sudan, were designed to feed the textile mills of Great Britain with cotton just as cotton production for French mills was an important part of the responsibilities of the Office du Niger. The Niger Agricultural Project in Mokwa, Nigeria, concentrated on peanut production with an eye toward exportation of vegetable oils.[28] The economic objective since independence, primarily has become the production of some food staple for the national urban markets. This is the case of SAED and of the various projects undertaken and foreseen in the Casamance region of Senegal,[29] which want to stop the necessity for importing rice in order to feed the Senegalese urban population. The rice cultivation project in the Kou Valley of Upper Volta has the same end, to help fill the growing demand for rice on the nation's urban food markets.[30] Often in such cases, the grain staple under intensive cultivation for the urban consumer is not, for one reason or another, a common part of the cultivator's diet as in the Yagoua, Cameroon and Bongor, Chad perimeters

where the rice produced is worth too much on the market for the cultivator to afford to eat it[31] and, the wheat which has been cultivated in the Bol polders project on the shores of Lake Chad, has been entirely for the urban markets.[32] The Sabi Valley Projects in Zimbabwe, however, are the exception that proves the rule.[33] The objective of these projects was the realization of national policy but, in this case, food for the urban areas was not important as the objective was to raise agricultural productivity in the African Reserves in order to permit resettlement of large numbers of Africans from the exclusively European areas of the country.

All agricultural intensification schemes, especially since independence, have preconceived social objectives; however, these objectives are generally seen in terms of increased income from the cultivation of produce for market. Where resettlement has been a criteria for supplying adequate labor in the project (in the Office du Niger, SAED's Delta perimeter, the Zande Scheme, the Niger Agricultural Project and the Volta Valley Schemes), the administration has made an effort to develop the social infrastructure; but, simple provision of needed infrastructure is a modest social objective. The projects which have not required resettlement, such as the upriver perimeters of SAED, the Yagoua and Bongor

projects, the Bol polders project and the projects in the Senegalese Casamance, have seen less effort than the resettlement projects for the provision of elements of a social infrastructure.

The social objectives always are subordinate to the national goal as, "Local interests are subordinated to a distant national well-being. The food budget of backward-seeming parts of the population and the quality of rural life count for little against the monetary requirements of a young nation and the pressure of a more explosive urban proletariat."[34] This is necessarily the case since the international credit of national institutions depends upon their ability to demonstrate the economic viability of the schemes. Thus, in all the Senegalese Schemes, in the Office du Niger and in the Upper Volta Schemes, the cooperatives organize, train and discipline the producer in the name of higher productivity. The schemes are not evolving in order to meet the producer's needs as he confronts suppliers of the material and services he needs or seeks outlets for the produce he chooses to market.

The social effect of agricultural intensification projects has been to convert the autonomous, impoverished peasant into something akin to a less-impoverished worker in the global economic system. "Inasmuch as the tenant's

area of decision is aimed more at reconciling the external constraints to his life situation than in making production decisions, he resembles the industrial wage-worker or other employee far more closely than he does the peasant."[35] Production decisions are made by the administration of the Scheme and whereas a peasant must resolve many problems in the interest of his own economic well-being, the tenant must always cede to the well-being of the scheme. The author noted the same phenomenon of tenant roles approaching industrial worker roles in the Senegal River Delta and, in fact, a discussion of the advantages of unionization has already begun there.

The perennial instability of labor indicated in almost all these projects is an indication of the failure of their social policy. Until recently, the shortage, instability and lack of commitment of labor in the Office du Niger had been a most salient aspect of the analysis of the scheme. It has bedeviled the Bol polders projects, was an important factor in the rapid demise of the Niger Agricultural Project, and migrant labor provides over 80 percent of the work force in the Gezira Scheme. The tenants in these schemes have simply not been able to establish themselves, with their families, permanently within the confines of the project; thus the schemes have merely become a channel for access to a

certain amount of food or cash, that part necessary to meet some of the worker's material needs. Reliance solely upon the scheme cannot provide access to all the resources needed for a full life.

The Local Point of View

There are two common approaches to the organization of labor within large-scale agricultural intensification projects. The first is the state farm approach, and the second the tenant farmer approach. The state farm approach was adopted in the Richard Toll perimeters, in certain zones of the Office du Niger, in selected zones of the M'Pourie perimeter in Mauritania, and in some of the early projects in the Senegalese Casamance. It is proposed for the central zone of the SODAGRI project in Velingara, Upper Casamance, as well.

The government agency responsible for the project, under the state farm system, hires labor by contract for field operations. The labor has no control over any production decisions or over the product harvested and is a salaried work force. The state farm usually relies on highly mechanized methods of production over large homogeneous surfaces, the rationale being, to profit from the economies inherent in such a scale of production. This large scale of

operations far surpasses that of a peasant family holding, but the state farm system has not been a great success from an economic point of view. The state farm system in the Office du Niger, for example, was a late development, beginning in 1948, an outgrowth of the shortage of colonist manpower. The creation of the state farm, with its heavy reliance on mechanized cultivation, increased cost of production:

> "Experience has shown that there are certain technical possibilities for mechanization in the Office du Niger and that mechanization has facilitated some operations. On the other hand, mechanization has not been sufficient to cope with all the bottlenecks in agricultural production; and it has given rise to problems of organization and management as well as doubts concerning its profitability."[36]

Furthermore, productivity has generally been lower in the state farms than in the tenants' holdings.

The state farm encourages the formation of a large mobile seasonal labor force in the rural areas because unskilled field labor is required only at certain times of year for operations such as seeding, weeding, or harvesting (although the operations making intensive use of local labor vary considerably from one project to another). Younger men of the local region, and many from outside, tend to congregate seasonally at the periphery of the state

farm in the hope of finding temporary salaried labor. Their remittances are a valuable supplement to their family resources when they return home.

The majority of large-scale agricultural intensification projects are organized on some form of tenant production system where, in general, the tenant is obliged to cultivate the crop mandated by the administration. All of the harvest, other than that authorized for home consumption, must be surrendered to the administrating organization at a price set by the central government although it is often considerably lower than that prevailing in the parallel market. Tomatoes grown in the SAED perimeters to supply the tomato paste canneries at Savoigne earned the cultivator a little over 6.8 cents per kilogram in the 1976-77 season while they were retailing in the village markets for five to seven times as much. The problem is not as dramatic for rice grown in the SAED perimeters. SAED paid the peasant just 18 cents per kilogram of paddy in 1976-77. The government-controlled retail price for milled rice was just over 38.6 cents per kilogram, while rice husked and winnowed at home sold on the parallel market for 50 to 60 cents a kilogram.

The scheme recoups the heavy costs of investment and administration through the low price it offers the tenant for his produce and it recoups the costs of field operations

by appropriating a portion of production for itself. There are two common accounting devices that the scheme uses to determine its share. In the Gezira Scheme and the Niger Agricultural Project the administration simply took a fraction of the harvest, 3/5 in the former case, 2/3 in the latter. This system has the advantage of increasing the project's income in proportion to increasing production but it has the disadvantage of reducing its income below the threshold of profitability if production is low. The advantage to the tenants is that they run no risk of debt accumulation from one year to the next and can acquit their financial responsibilities to the scheme in their entirety, no matter how low their production. The scheme, of course, retains the right to exclude tenants whose productivity is consistently too low to recoup the administration's share of the production costs. The disadvantage to the tenants is that the scheme gets a large portion of their production at all levels which dampens their interest in increasing production.

A debt accounting system is far more widely used than the fractional sharing system. SAED uses debt accounting in all of its perimeters as well as does the SONADER system on the Mauritania bank of the Senegal River. It is also the system used by Office du Niger, the SEMRY in Yagoua, and

the Upper Volta resettlement scheme in the Kou Valley. Each tenant contracts a debt to be repaid in kind at harvest time for the mechanical services, seeds, fertilizers, pesticides, hand tools, water and perhaps even land rights put at his disposal during the growing season and each tenant's debt is uniquely his with an individual mix of these factors used in his debt calculation. The advantage to the scheme is that, even in years of low productivity the accountants will be able to show clearance of operating costs even though these costs may not be collected from the tenant for several years. The case of the SAED Delta perimeter, which has had consistently poor harvests, illustrates the advantage. The disadvantage is that the debt declaration limits the share of the tenant's production which can be appropriated; although, the scheme can increase its share, in cases of increased productivity, simply by adjusting the price paid the tenant for his production. The advantage to the tenant is that he has an incentive to increase his production, as once he has cleared his debt, he may keep for himself the full value of his production at the official price. The disadvantage to the tenant is that he owes his debt in any case; whether he has had a good or a poor harvest, he must repay the administrating agency for its services. The government of Senegal absolved tenant debts only during the worst years of the drought.

Several of the projects under discussion, for reasons the author cannot explain, mainly projects in countries such as Senegal, Mauritania, Mali and Upper Volta, all former French colonies, promote cooperative organization among the tenants. The cooperatives are organizations of tenants who exploit fields in a common zone and inhabit the same village or group of villages in the zone. Cooperative organization in this context has virtually no advantages to the tenant because a cooperative cannot act as a unit to put pressure on produce buyers since the administrating agency has given itself monopsomistic control over produce marketing. It also cannot exert price pressure on suppliers of material, as the administrating agency has the monopoly. The members of the cooperative cannot reap the benefits of collective work as each family unit is individually attributed a plot according to the number of members in the family. The head of the family represents the family in the cooperative councils but the debt contracted in cultivating the plot is in his name. Other male family members, when they reach a certain age, may be admitted as members of the cooperative, but they are then attributed a plot in their own right for which they alone are responsible and the family plot they had been working on is reduced in size by one share.

The largest unit of collective work allowed by the cooperative is the family, but collective work, both within the extended family and/or within such things as local age-grades, has been a common practice throughout the Sahel for centuries. Since the creation of the perimeters in Bakel, SAED has been having conflict with its tenants who refuse to sacrifice collective exploitation to the requirements of the cooperative organization SAED is imposing there. In Upper Volta many "families", members of the cooperatives, are, in fact, collective groups that have coalesced to take advantage of the project. They often experience tension and conflict over the distribution of their profits because the cooperative is, of course, ill equipped to mediate such internal "family" disputes.

The cooperative thus becomes little more than an instrument for the administrating agency to fulfill its ideological objectives. It has no different function than the division of the Gezira Scheme into irrigation blocks provides only a framework to integrate the tenant into the organization, to know his spatial location, to establish his position in a hierarchy for transmission of communications, to establish a structure to facilitate training and extension work, and to ease the otherwise arduous accounting responsibilities of the administration.

Whatever the appellation for the framework which organizes tenant activity in the field, participation in a large-scale agricultural intensification project has similar social repercussions. "The extended family as a production and consumption unit became largely irrelevant. The nuclear family came to the fore as the crucial social unit of production and consumption."[37] The organization of production is given to the tenant and the only way he can escape it is by choosing not to adhere to the project. In all the projects under consideration, the organization of production focuses on the nuclear family as the primary unit of production and consumption. The land is allocated to the nuclear family head, the debt is contracted by him, and he is the recipient of whatever cash return his plot earns. As seen by the example of collective groups presenting themselves as "families" in Upper Volta, monetized cultivation sows discord in the midst of large groups because large family groups tend to segment when money is involved. In practice, large-scale agricultural intensification projects lead to the dismantling of the extended family.

Pastoralists who have chosen to take part in the activities of the agricultural intensification projects have a perspective on the projects appropriate to their particular subsistence interests and,in many project areas, the

pastoralists soon found that cultivation in the irrigated perimeter was a far more productive supplement to their herding activities than had been the haphazard rain-fed millet cultivation practiced alongside their settlements, especially following the severity of the drought. Pastoralists in the Senegal River Delta now have become enthusiasts of irrigated agriculture particularly after experiencing the severity of the drought. They are anxious that SAED proceed with expeditious development of perimeters for their use and this sentiment is not relegated to the Delta alone as it is shared by the riverine pastoral communities farther up the Senegal.[39]

The sedentary cultivators must leave the irrigation projects seasonally to search for work in order to compensate for the inadequate returns of participation but the pastoralists find the projects just the element they need to make continuation of the pastoral lifestyle a viable strategy; however, participation in the Delta perimeters provides neither pastoralists nor cultivators with an adequate livelihood. The pastoralists are willing to accept participation only as a secondary activity and stock raising retains their primary interest. As long as it is possible for the pastoralists to, in effect, divide their families, and pursue both cultivation and herding, their lively interest in the perimeters can be expected to remain.

The farmer who neighbors a large-scale agricultural intensification project, profits from the possibility of sending his sons to work within the perimeter either as laborers on the state farm, or as sharecroppers on tenants' holdings. All projects rely, more or less, on temporary field labor supplied by young men living far enough outside the project perimeter so that they do not have tenancy rights. It is common, however, for the administrating agency of the project to discourage this practice and the Office du Niger reduced the size of tenant holdings at one point to limits capable of being cultivated solely with family labor. Along the Senegal River, hired field labor is generally paid by the day but, if the laborer replaces the tenant for the entire cultivation season, the tenant awards the laborer one-third of the harvest if he was provided room and board and one-half if he had to fend for himself.

Cultivating neighbors may lose the right to exploit certain parcels formerly included in their inventory, but generally are compensated to some degree by acquiring cultivation rights within the project perimeter. In the Velingara area of the Senegalese Casamance, mixed cultivators have requested that their sons be given preference in hiring on the state farm area of the SODAGRI agricultural intensification project because they feel such preferential treatment

would be a certain compensation for the transfer of their best dry season pastureland to the SODAGRI domain.

The herders who neighbor the agricultural intensification projects undergo more severe losses, often experiencing the withdrawal of some of their herd's best pastureland. This is especially true in projects which pursue multi-seasonal cultivation because, in river basin areas in the Sahel, cattle generally move away from the river during the wet season and, at that time, when the riverine cultivators are working their fields, the cattle's presence would provoke conflict. The dry lands away from the river have plentiful standing water and sweet grass in a normal year while, after the harvest when the dry season begins and surface water and grass have generally disappeared in the dry lands, the cattle can move back toward the river where they will no longer interfere with cultivation. If, however, irrigated perimeters are cultivated during two and perhaps three seasons a year, the herder has to find an alternative dry-season resource for his cattle.

The predicament of the herders who neighbor the agricultural intensification schemes reaches its extreme for those who are virtually displaced by the projects as happened in the Senegal River Delta. The herders of the area had to shift the locus of their herding activity considerably to

the south of their home area where the herds now are left in charge of the unmarried men whose discipline is somewhat lax away from the supervision of more mature adults and there are frequent fights among the herdsmen of different refugee herds who have come to the area. The married adults have stayed in the home area, cultivating rice during the rainy season and tomatoes during the off-season profiting from the proximity of the irrigated perimeters.

The restriction of herder movements, or the displacement of the herds, tends to lead to increasing cattle densities on the land that remains open. Such tendencies have made a major contribution to the desertification of the area universally noted in the early seventies. Continued displacement of herds in the wake of the accelerating development of large-scale agricultural projects can lead only to further desertification if no counter measures are provided. The same phenomenon occurs in the interior Delta of the Niger River, where an elaborate range management scheme dating from the 1820's has been disrupted by the incorporation of larger and larger tracts of pastureland into hydro-agricultural projects.[40]

> Pastures are becoming rarer in the rice-growing area; furthermore, because cows have damaged canals and waterworks, their exclusion from the developed zones is being considered. The inhabitants of the area (Yagoua) regard hydro-agricultural developments as deleterious to

> fishing and incompatible with the sedentary raising of cattle."[41]

The impact of the large-scale projects on fishing has not been widely discussed but the continuation of the fishing economy in the vicinity of an irrigation project is contingent upon the ecological changes wrought by the project, as diking the perimeters often excludes fish from prime spawning and feeding areas. Certain species of fish are endangered by increased pesticide usage.[42] On the other hand, the canals of an irrigated perimeter may spawn a few hardy species living off the detritus of cultivation as in the Senegalese River Delta, where catfish have become the main source of animal protein in an otherwise impoverished environment.

Displacement for the cultivator means disruption of his former pattern of land tenure. The only factor of production over which he retains control, is his own labor which, by and large, these former landholders choose to hire out to the project. The Senegalese government passed the National Domain Law of 1964 in order to expropriate lands that, by its determination, could be put to better use in the service of national development. Expropriation in the Senegal River Valley is made without compensation although, the displaced users are generally guaranteed

cultivation rights on the intensification scheme implanted there. The Sudanese government, in the Gezira Scheme, pays landowners an annual rent for use of the land which was facilitated by the emergence of private land ownership from the debris of the Mahdist state in the late 19th century. Private land ownership is elsewhere uncommon in the Sahel and the general practice is to locate the project on the land declared "under-utilized," to displace the population in the name of national development policy, and to compensate the people so displaced by offering a chance to participate in the project on the same terms as other adherents.

In many cases, certainly in the case of the Senegal River Valley, such a system is accepted by the former landholders because productivity over the last decade has been so low on most Sahelian lands that people are receptive to any scheme that promises increased yields. People have a notion of what is fair or unfair but retain as their primary short-term interest, access to adequate foodstuffs. If a large-scale agricultural intensification scheme can offer them the wherewithal to maintain themselves biologically, it will have won their loyalty for the time being.

Convergence and Conflict

The interests of the parties involved in schemes converge in increased production, and, especially in the more recent schemes, in increased production of foodstuffs as the last decade has been marked by a penury of food production in the Sahel. The Office du Niger has had no difficulty in attracting colonists since it abandoned cotton production and since the drought demonstrated the security of cultivation within its confines.

Few projects, however, offer their adherents a net annual income substantially greater than that of the rural cultivators in the area. The average cultivator in Yagoua netted $126.60 from a half acre plot of rice in 1973.[43] The average cultivator in the Office du Niger netted in the neighborhood of $130 per hectare of rice in 1973-74[44] where the average tenant was cultivating one hectare per family member. Sawadogo claims the average settler family in the Kou Valley of Upper Volta was netting slightly over $1,000 in two crops on its one hectare plot in 1971, although his phrasing is ambiguous and he may be presenting theoretical rather than actual yields.[45] There is a tendency to form composite families to exploit the works in the Kou Valley, thus more adults share the earnings than in projects elsewhere. The average family in the Dagana sector of the Dagana

perimeter of SAED netted $260 from its one hectare plot in 1975-1976.[46] The following year, 1976-77, netted cultivators in the Nianga perimeter of SAED, $230 on each family's half hectare plot. The same year in Dagana each family netted around $1,000 on its one hectare plot.[47] A net average annual income of $272 on a ten feddan family plot, 4.20 hectares, and somewhat more than half that figure on a five feddan plot was estimated in a village in the Gezira.[48]

The net income in the Gezira is higher than it appears since it does not take into account the marketing of the food grain which is grown alongside the cotton. Presumably in Gezira nearly all income is disposable income whereas in most of the other schemes, net income or the value of the crop at official market prices after repayment of the cultivation debt, must be reduced by a family nutrition factor of about 300 to 400 kilograms of grain per family per year in order to find the disposable income. Each family in the Yagoua area has four to five members and at the price SEMRY pays the cultivator for his rice of 13.6 cents per kilo, a family's disposable income derived from participation in the project is negative. Rice becomes too expensive for consumption by the cultivator's family and cultivators prefer to sell 90 percent of their rice buying millet with the proceeds.[49]

The average family size in the Office du Niger in 1974-75, was about ten members.[50] The 9.1 cents per kilogram that the scheme pays the cultivator for his rice, gives the average cultivator's family no disposable income although it has food grain for a large part of the year. The size of the average family in the Kou Valley is slightly over nine members and, at the official price of 10.5 cents per kilogram paid in 1971, the members of the family have over $600 to divide among themselves after taking out food needs for the year.[51] The average family size in the Senegal River Valley is estimated at seven members.[52] The official price of 18.9 cents per kilogram of paddy gives the average family only in rare cases, any disposable income over its food needs.

It is obvious that the project participant does not require a substantial disposable income, that the security given by meeting a substantial portion of the family's food needs through the project will maintain his participation. Projects which cannot meet that minimum requirement will risk complete collapse. Productivity in the zone of Kassak in the SAED's Delta perimeter has not enabled the tenants to clear their debts on a regular basis, let alone feed their families up to the time of the author's field work in 1976-77; however, things may improve with the recent advent of more refined irrigation works. The Niger Agricultural Project in Nigeria has shown:

> "in the first two years the average incomes actually earned by the settlers were only a half to three-quarters of what the average local farmers were obtaining on their much smaller plots without the aid of mechanical equipment. In the third year the overall average seems to have been about the same as on local farms."[53]

Without the stimulus of the gnawing insecurity that attends cultivation in the ecologically more delicately balanced northern zones, the Niger Agricultural project was not able to survive a fifth season.

The convergence of interest between herders and the project is similar to that between cultivators and the scheme although the herders' requirements of the projects are fewer than those of cultivators as the herders' primary resource remains their cattle. The scheme retains their interest by offering them secure access to food grain in greater abundance than provided by their former methods of cultivation but that access must be without crippling interference in the exploitation of their herds.

There is a divergence of interest between the scheme and the participants in its activities because, apart from a few exceptions, the most the average cultivator can expect from participation in a large-scale agricultural intensification scheme is the provision of a substantial portion of his family's annual subsistence need in food grains. He feels it worthwhile to deliver a substantial portion of his

annual productive effort to the scheme for that provision while, at the same time, he has other interests in other socio-economic domains.

The cultivator has formulated his response to "Development for Whom?", as one tenant in the Senegal River Delta told the author, "We do not agree that the government develop Senegal on our backs." The tenants, therefore, adopt a subsistence strategy that integrates participation in the scheme to the limits of its advantage to them; but, they refuse to abdicate their interests to the interests of the scheme. Consequently, only a rare large-scale agricultural intensification scheme can hope for economic viability under present circumstances.

One needs only to look at the linkages between the schemes and the global economy in order to understand the conflict of interest between the scheme as a corporate entity and the participants as family heads. All large-scale schemes take tremendous infusions of investment capital. SAED's future works will cost about $5,100 per hectare; the pilot project in Boghe, Mauritania, will cost over $11,100 per hectare;[54] the pilot project on the Gorgol River in Mauritania, begun in 1975, has cost $7,000 per hectare.[55]

No Sahelian government has the means, purely from its national treasury, to underwrite development projects of the

magnitude under discussion; therefore, development policy is invariably among outstanding political questions in all Sahelian countries. If it is felt that rapid development is more important than autonomous development, the persons in power appeal to international financial institutions for provision of the necessary funding. Few governments are willing to confront the impatience of a languishing population while attempting to muster meager national resources in a campaign of localocentric development. Moreover, international financial institutions are anxious to underwrite the costs of good administration with an eye toward national development.

The appeal to international financial institutions requires articulation of the scheme with the requirements of the global economy and there are an infinite number of proposals in the world to drain investment funds. It is for determining the most efficient allocation of scarce investment capital, that international financial institutions use the project analysis method.[56] The keystone to the project analysis method is an analysis of the economic viability of the project, usually from a cost-benefit point of view. Institutions are reluctant to finance projects which they know require indefinite subsidies to remain in operation. Therefore, in the interests of national development, a

government courting the international financial institutions presents only projects that show a reasonable probability of balancing their accounts.

The national government must build the organizational framework for the project structuring it more to the requirements of the international capital markets than to the normal behavioral patterns of the persons to be the beneficiaries. Consequently, all large-scale projects must concentrate on production for market; while the participant's interest lies, above all, in food production. Thus, unaccustomed to eating wheat he has not embraced the Bol Polders project in Chad; unaccustomed to eating rice which is, moreover, too expensive for him, his loyalty to the Yagoua project is problematic, while SAED tomato producers are becoming increasingly restive about cultivating a crop which is so perishable that its only practical use is for cash.

The scheme must have monopsonistic control over the purchase or production in order to meet production costs, and in no scheme under consideration, is the cultivator authorized to sell his product to other than the scheme which gives the producer significantly less for his produce than he could get in the parallel market. Free market sale of produce would jeopardize the ability of the scheme to meet its costs without requiring a substantial subsidy.

All of the schemes under consideration have opted for mechanized field operations which gives only the advantage of central control over the timing of cultivation activities and has all-too-frequent mechanical breakdowns. The poor fiscal record of the Office du Niger is due to its increased mechanization after 1948,[57] and it is felt that mechanized methods in Mokwa were less profitable than customary local techniques.[58]

Mechanization raises the production costs although it enforces a certain discipline in the schedule of operations. The importance of maintaining work discipline in this and other ways is consistent with the quasi-industrial worker role of the tenant. A staff of extension personnel is available to oversee field operations and to give advice as problems arise because most tenants in most projects are unfamiliar with both the crop and the techniques used to grow it. Extension personnel are the project administration's representatives in the field giving advice on increasing production to the tenant while also feeding information about unproductive or recalcitrant peasants back to the central staff. All the projects under consideration have a mechanism for "firing" or excluding tenants because of either consistently low productivity or consistent refusal to repay debts.

Quite simply mechanization is not a rational economic choice where labor is cheap and abundant, as in West Africa.

> "It is, however, by no means clear that a large-scale mechanized agricultural scheme is compatible with the settlement on it of peasant farmers. Peasant farmers are usually thought of as growing what crops they like, how they like and when they like on land over which they have undisputed right of usufruct. Large-scale mechanization demands agreement to grow crops which can be cultivated by a uniform method over a wide area. Any attempt by an individual farmer cultivating part of the area to grow a different crop, or to neglect any part of the sequence of agricultural work might jeopardize the success of the whole scheme. His rights must therefore be severely curtailed and only those willing to accept such curtailment can be admitted to take part in the scheme. Such 'settlers' must be willing to accept the status virtually of a paid labourer. Whether they are willing to do so will depend on the 'real' income they obtain compared with that obtained in their former way of life."[59]

The divergence of interest between the schemes and the tenants takes on an added dimension when the scheme moves toward multi-season cropping in its perimeters. It is a waste of scarce resources to leave the works, developed at great expense, idle for half the year or more so it is far wiser financially, to distribute the burden of amortizing the works over as many crop seasons as possible during the life of the works. Since the primary interest of most tenants in the projects is acquisition of a substantial portion of

their annual family food needs, tenants have shown an attenuated willingness to accept the discipline of the scheme off-season and often feel that their interests can be better met by pursuing activities outside the scheme. Thus, in the Senegal River Delta, participation in off-season tomato cultivation has been diminishing in favor of seasonal labor migration where rewards are greater and requirements leave more latitude to personal inclinations.

People are not willing to confer the sum-total of their worldly interests on a large-scale agricultural intensification scheme. The tenants feel that the scheme pursues its corporate interests apart from the tenant's interest clearly demonstrated by the official price offered for produce, by the restriction on crops cultivated, by the monopsonistic control over purchases of tenant produce, by the monopolistic supply of cultivation material and services, by the inflexibility of cultivation methods and by the threat of exclusion from cultivation rights for infractions of discipline. For these reasons, the tenant is not committed to the scheme.

The organization of production within the projects fosters nuclear family interests to the detriment of extended family interests. The tenants feel they must safeguard their social interests by maintaining extended family

relations because the extended family can be a formidable resource in times of need. The dry season, after harvest, is also a time for festivals, visits, politicing and a general reactivation of social ties left in hibernation since the beginning of the rains several months before. Multi-season cropping, an economic necessity for large-scale schemes, by its very nature interferes with the maintenance of social ties which the tenants feel are essential to their material as well as psychological security.

At the same time that tenants retain a strong interest in the continuance of extended kin relations they retain a strong interest in the pursuit of a wide range of subsistence activities. The least successful projects from the tenant point of view, are those that most narrowly restrict his range of productive activities because of the scheme's economic necessities. The most successful projects have been those that tolerate or encourage tenant participation in subsistence activities of no economic interest to the project.

The Bol Polders Project on Lake Chad had great difficulty maintaining its labor force when cattle were excluded from the area and when participants discovered that the labor requirements of wheat cultivation precluded millet cultivation and even fishing. The level of remuneration and securit

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of tenure did not inspire participants to devote their entire productive efforts to wheat cultivation. The peculiar ecology of the Senegal River Delta forecloses virtually all cultivation outside of the natural depressions diked by SAED as the Delta soils are far too saline. Moreover, conversion of these natural depressions to hydro-agricultural purposes has meant the virtual disappearance of pastureland in the Delta. Labor has been exceptionally unstable and undependable in this zone as at the Bol polder.

At the other extreme are such projects as the Gezira Scheme or the Office du Niger where land is set aside for tenants to grow what they please without contracting a debt. The tenant acquires subsistence production land far more dependable in its productivity than that available outside the project perimeter, in exchange for seasonal participation in project activities. The opportunity to grow subsistence crops in irrigated plots is felt to be responsible for maintaining tenant attachment to the Gezira Scheme.[60] An irrigated rice scheme that proposes, among other things, setting side a block of land at the periphery for multiplication of selected millet seed, is under discussion for the area around Malo on the Logone River in Chad. The seed would be distributed around the region to improve the strains now under cultivation while, in the meantime, the tenant in the rice

scheme would be assured of his normal subsistence food crop from the autonomous cultivation of millet. The proposal bears further study as the requirements of such millet production may not be as supple as the rice scheme tenants need. On the other hand, such a proposal recognizes a critical shortcoming in other projects.

Large-scale schemes are almost inevitably resettlement schemes and this has been the case with the Senegal River Delta perimeters, with the Office du Niger, with the Niger Agricultural Project, with the Kou Valley projects, with the agricultural projects in the Volta Valley in Upper Volta,[61] and in the Zande scheme. Population densities are so low in most parts of the Sahel that, even without mass resettlement, most large-scale projects must hope for a substantial increase in local population if they are to meet their labor requirements.

The forced resettlement of Mossi peasants in the Office du Niger was a failure and later voluntary resettlement efforts have not been crowned with great success. The SAED experience in the Senegal River Delta is representative. "A common characteristic of settler communities has been their heterogeneity."[62] Heterogeneity may mean ethnic heterogeneity or it may mean simply that people settled in one village have such diverse origins that they have no basis for mutual

confidence. The consequence has been constant tension, conflict and schism in the cooperatives in the Delta. In one village in which the author worked, the breakdown was over the inability of the treasurer of the cooperative to give a proper accounting for the funds that were generally believed to be in the treasury. In a second village the breakdown was over the criteria of exclusion to use in response to SAED pressure to separate absentees and defaulters from the committed tenants.

Resettlement involves uncertainty and a sense of insecurity even for the most well-motivated candidate. Provision must be made for congenial housing and the supply of adequate nutrition until the first harvest. Insufficient attention to these matters sparked the first crisis of confidence within two months of initial settlement in the Delta perimeter.

Voluntary resettlement schemes tend to attract highly motivated but rootless people including in many cases a disproportionate number of young unmarried men. Their presence in composite "families" gives the Kou Valley projects their unique social complexion. In the Senegal River Delta there are very few men over the age of 60 and very few under the age of 30. Voluntary resettlement projects usually skew the age pyramid in this way to exclude older men who, in

rural settlements elsewhere, would be in positions of political and religious authority. Voluntary resettlement villages, therefore, exist outside the social structure of the areas in which they are implanted and normal networks of social relations are absent. Often, as in the Senegal River Delta, people look for spouses in the home areas rather than in the resettlement site further delaying the establishment of a fine meshed network of social relations at the new site.

Relocating prospective tenants to the site of a large-scale agricultural intensification scheme is simply one more force increasing the cost of the scheme and adding to the social turmoil of adaptation. "When all these points are taken into account the case against high capital and complex settlement schemes becomes stronger than when only conventional cost-benefit criteria are used."[63] Scudder, who has written extensively on the problems of resettlement, has as harsh an assessment,

> "The world-wide failure rate of settlement schemes of all sorts is discouragingly high; both from the point of view of the settlers and from the point of view of the planners. While I do not wish to imply that the settlement schemes should never be attempted, they should only be initiated after a careful consideration of the alternatives and of the ecological, administrative and socio-economic difficulties and high financial costs."[64]

The interests of large-scale schemes also clash with the interests of several sub-groups in their tenant populations because of the peculiar characteristics of each sub-group. In principle, with the exception of those resettlement schemes worked disproportionately by single men, approximately half the people who owe their material needs to the schemes, are women. Little mention of the woman's position and the role they play in the structure of the scheme is made in the literature, least of all in the official descriptions. Women, in fact, generally become economically disenfranchised with family adherence to a large-scale agricultural intensification scheme.

Several nuclear families, related by close kin ties, collectively exploit the land over which they have use rights in non-monetized subsistence production systems common throughout Africa. The entire group, including children, contributes to production and all share in consumption although the harvest is nominally under the control of a senior member of the group. Little advantage is gained in this system by control of the group harvest since there are natural limits to food consumption. However, in a monetized economy, there are no limits to the possibility of dispensing cash receipts. Since parcels in a large-scale project are, except for exceptional cases such as

widowhood, allocated in the name of the male nuclear family head, the male family head is the recipient of the cash reimbursement for sale of produce at the end of the season. The work a woman contributes in the field accrues to her husband rather than to the family as it would in subsistence production.

With the advent of the cash economy in the Sahel, men and women began cultivating small plots of cotton or peanuts, in their spare time, after they had met their responsibilities on the family-group subsistence plot. Women were, thereby, able to earn a modest sum of money which they controlled completely; however, even this opportunity is foreclosed within the large-scale projects, especially in those projects pretending to give its tenants full-time employment.

The large-scale agricultural intensification project doubly demotes a woman's position. She is first demoted, along with her husband, as the family assumes a dependent position in the hierarchical structure that culminates in world financial institutions. At the same time, she tumbles from her complementary economic position to become her husband's dependent in a way not often encountered in the Sahel.

Another group whose interests clash with those of the scheme contains all those who choose to keep cattle. Because

the presence of a large-scale agricultural intensification project means restrictive access to customary pastureland, cattle herders must adjust their transhumance cycles in order to adapt to multi-season cropping on land which they had been accustomed to using, especially in the dry season, for their cattle. Normally herders try to adjust their interest in cattle keeping with an interest in growing produce under irrigated conditions. The problem is often aggravated in good years by the tendency of farmers and herders to invest a portion of surplus funds in cattle purchase. The author was told repeatedly, by prospective SODAGRI tenants in the Velingara area in the Casamance, that cattle purchase would be a high priority for them if they had a significant cash return. The same attitude exists in the Sabi Valley projects of Zimbabwe. If the project experiences any measure of success, the presence of increasing numbers of cattle in its vicinity can pose a problem. For that reason, most projects have attempted to expel cattle from the project area.

There is a decline, in many large-scale projects, in dietary quality in spite of burgeoning grain supplies for the urban population. The expulsion of cattle and the sharp decline of the local fish population combined with an increase in the human population necessary for field labor, means less

access to high quality protein for the average citizen; although daily caloric intake may increase. Whether this dietary deficiency may have repercussions on local health is not here judged but it is clear that large-scale works, especially irrigation works, contribute to increased incidence of certain diseases.[65]

Proposals for Increasing Tenant Benefits

The major problems that besiege the tenant of a large scale agricultural intensification project are inherent in the structure of the project as the project is formulated at the level of national and international institutions and is required to meet criteria set at those levels to measure its success. Fulfillment of project requirements becomes the responsibility of the tenants as they rely on it for a dependable food supply to which fear of impending drought adds a stimulus. Otherwise, the project has little appeal, and the tenant intermittently must seek elsewhere for supplementary income. The project's economic requirements have also fostered social instability among the families of the tenants because families have to detach members, family heads or unmarried older sons, to work at other sites in the interests of the whole group. The project also has fostered, because of the social organization it has imposed

on production within its confines, a status of dependence for its tenants which undermines a tenant's feelings of security and, thereby, undermines his commitment to its success.

There are two alternatives for increasing the tenant's commitment to the project. The first alternative involves a substantial increase in tenant benefits without changing the structure of the project; however, this would mean greater capital outlays in order to make the project more dependable from a technical point of view. Debt service and amortization costs would be much higher and would probably transform the project into a parasite dependent on substantial cash infusions from the national treasury in order to remain viable. Moreover, the government would either have to raise the official price it gives the tenant for his produce or to allow him to sell it freely on the parallel market. The government, in the former case, would have the choice of passing the price increase on to the consumer or of absorbing the increase through subsidies; in the latter, the consumer would pay directly in the market. The burden of underwriting the large-scale agricultural intensification project in any alternative will be shifted from the tenant to the urban consumer and/or the tax payer. For that reason, the alternative of increasing the tenant's

benefits to the point where he becomes committed to the project is not politically realistic. The author cannot envision any government in the Sahel hardy enough to withstand the political turbulence that would follow a rise in the market price of tenant produce, or a rise in taxes necessary in order to maintain a new official purchase price.

Rather than give the tenant more benefits, the author is far more interested in a second alternative which would require less adherence to the discipline of the project. Pursuit of this alternative, however, means, by logical extension, eschewing further large-scale projects on principle and even more fundamentally, it means a reformulation of the focus of development efforts. On whom are these efforts to be focused?

The only means, therefore, acknowledging the force of cost-benefit analysis criteria in determining the appropriate structure of a large-scale project, of loosening the hold of the economic requirements on the tenant's behavior is by reducing the economic requirements. They, in turn, can be reduced only if there is a reduction in the scale of the project which, at any rate, have generally exceeded the point of diminishing returns. The cost per unit product for a smaller-scale project is less than that for a large-scale project so that, unless development is in the

name of the urban populations who rely on inexpensive produce, a reduction in scale of operations would seem most appropriate from an economic as well as a social point of view.

There have been suggestions that the scale of agricultural intensification projects should be governed by the scale of irrigation or flood recession cultivation systems that have been developed in the rural Sahel by efforts of the local people over the centuries. The Bol polders began as an attempt by people on the Lake Chad periphery, to control the lake's annual recession to benefit cultivation. Flood recession farming has also stimulated great interest in the Logone flood plain, in the Niger River Valley, in the middle sections of the Senegal River Valley, and it is common to see a type of flood recession agriculture done in the alluvial clay bottomlands of natural depressions in the central areas of Chad and in the Upper Casamance and Eastern Regions of Senegal. However, in all but the latter two cases, flood-recession farming is under assault. Two dams proposed for the Senegal River will be responsible for controlling the river's flow in order to allow year round navigation between Kayes, Mali and the ocean. Regulating the river flow will, however, virtually wipe out the continuation of flood recession agriculture and the new generation of improvements on the Bol polders will supercede all vestiges of local development and local control.

Little has been done, to date, for the cultivation of bottomland; although discussions are underway in Chad as to the course to take. A series of projects in Senegal, dating from the 1950's has had little success in converting the bottomland into small rice perimeters because no direction on improving the bottomland to increase control of water and productivity has been given. Many men tried rice cultivation in the 1960's but abandoned it as peanuts remained a more lucrative cash crop.

Sahelian areas which have locally developed, still active, irrigation or flood recession agriculture are relatively few and are, as in the Senegal River Valley, declining in number. Certain principles in these exploitations, however, can be adapted to provide the basis for low capital intensity, low technological intensity perimeters on potential irrigation sites throughout the Sahel. These principles are:

1. Ownership of perimeter land vested in a village-centered cooperative.

2. Works built by local labor; no imported machine labor.

3. All villagers who elect to participate in cooperative activities receive a share of the perimeter according to family size.

4. Participants free to incorporate use of the perimeter into their subsistence strategy on their

own terms. They market the crops they choose to cultivate where they please and to the degree they see fit.

5. Maintenance of the works is the responsibility of the cooperative.

These five principles are not sufficient, however, to guarantee the productivity of a small-scale works and experience has shown that villages need three additional contributions from outside sources;

1. A diesel pump, adapted to the area from the point of view of operation and repair.

2. Technical advice on the construction of the perimeter.

3. Extension services during the cultivation season.

Given these three contributions from the outside, it is appropriate for the liaison agency between the national government and the village cooperative to require each landholder to reimburse it in kind, according to the size of his holding, for the services delivered. The burden of this debt will, however, be considerably less than that currently borne in the large-scale projects.

The investment costs for construction of small-scale perimeters is more modest than those for large perimeters. The cost per hectare, of large-scale perimeters on the Senegalese bank of the Senegal River Valley, has been given

as slightly over $5,100 but the documentary source of that figure also contains a cost estimate for construction of small perimeters in the same area which is slightly over $2,900 per hectare.[66] Small-scale perimeters in the Upper Senegal Valley have been estimated to cost around $1,000 per hectare.

Mauritania has probably more experience with small-scale perimeters than any other Sahelian country. In 1976, a cost of about $1,950 per hectare was estimated for a group of fifteen projects whose construction should now be underway.[67] A reduction in the investment capital required to put a project in operation means a concomitant reduction in the amount of capital the administrating agency needs to recoup from its tenants in order to meet its financial responsibilities to the world economic system. This reduction can be passed on to its tenants by relaxing discipline because all the administering agency would need from the land holders (they need no longer be "tenants" under these circumstances) is a return enabling it to meet its obligations. Thus, the land holders could make use of the small-scale perimeters for their own interests.

Treating small-scale perimeters in this way, of course, means a major revision of the objectives of agricultural intensification projects. No longer could production for

market be the primary objective. The administrative agency would have some impact on the national and, by extension, international markets by its control of the limited amount of production sanctioned for debt reimbursement but the primary objective of the small-scale perimeters must be the provision of a new resource. The small-scale perimeters must aim at creating an autonomous peasant class capable of choosing from several strategic options to attain economic self-sufficiency. Seen from its most narrow perspective, this means food production for local consumption will be the primary objective. Rural food self-sufficiency will, moreover, ameliorate the impact of unforeseen ecological/climatic problems such as the recent drought, and reduce the human cost of delays in relief aid.

The small-scale perimeters of the author's experience lie within Mali, Mauritania and Senegal, three of the four countries that share the Senegal River Valley. They have had a checkered history and they cannot be termed successful. The first generation of small perimeters in Senegal failed because of its technologically unrefined, low level of control over water. Small-scale perimeters in Mauritania have been stumbling along with haphazard administrative support since 1966. Fourteen projects were in existence in 1976 and fifteen more were planned. With better support they

would all be more dependably productive. Mali, only recently, began developing small-scale perimeters. Its OPI/API (Operations Perimetres Irrigues/Activites Perimetres Irrigues) organization has been in existence only since 1974-75, and an assessment of their activities at this time would be premature.

A UNDP/FAO report on irrigated agriculture in the Senegal River Valley provides the outline of the indictment that proponents of large-scale perimeters deliver against small-scale projects[68] but the author knows of no full-scale critique of small-scale perimeters. The major problem of the small-scale works is management because, the peasants do not have the technical background for maintenance of the works or the pumps after they are put into operation, and they lack enough accounting experience to allocate debt charges equitably. Furthermore, technical and administrative support is difficult to obtain for small-scale projects in isolated areas dispersed around the countryside. Small-scale perimeters present a tremendous logistic challenge to the administering agency.

The UNDP/FAO report concludes with an enigmatic criticism of the autonomous productive strategy based on a low level of mechanization. "The search for autonomy leads to economic aberrations."[69] This tantalizing remark is

hardly self-explanatory; on the contrary, given the author's present inclination toward a point of view in direct opposition to the UNDP/FAO analysis on this point, it is felt that there surely must be some more stimulating antecedent to such an otherwise gratuitous remark.

Other aspects of the UNDP/FAO critique are more apt as peasants will certainly require substantial technical training and supervision before they can hope to use and maintain works efficiently and before they can hope to keep accounts equitably and support for small-scale perimeters will certainly present a tremendous managerial problem. But, large-scale perimeters present managerial problems just as humbling even if varying in kind. Breakdowns in the highly centralized large-scale project structure can prejudice the productivity of several thousand hectares and thereby, the interests of hundreds of tenant families, if they occur at a particularly critical point. In all eventualities, the losses from breakdowns in a small-scale project are far more limited by virtue of their smaller size.[70] Large-scale projects, for all their much-touted efficiency, have compiled a mottled record of central responsiveness to concrete problems arising in day-to-day field operations.

Many of the difficulties that have been responsible for productivity curtailment in SAED and Office du Niger, have

been the result of shoddy technical planning and the works under these plans have often been executed by expatriate public works companies from standards that have meant low productivity, over vast areas, at great expense. The burden of such malfeasance rests most heavily on the tenant; while no project, large or small, could ever be sheltered from incompetence, fewer people are affected by difficulties on a small-scale project than on a large-scale one. Minimizing risk is more important than maximizing profits on the periphery of the world economy.

Smaller projects contain the possibility of their spontaneous reproduction among the people neighboring them. A village near Bakel, Senegal under the leadership of one of its members, who had spent time as a migrant laborer in France, developed its own small-scale irrigated perimeter.[71] The author has encountered two villages on the Mauritanian bank of the Senegal River that are embarking on a similar project, organized and only awaiting some outside technical assistance and a pump. There are several private small-scale perimeters on the Mauritanian bank already in operation.

One of the ironies of Mauritania's mediocre administration of the small-scale perimeters has been an off-hand encouragement to their extension as there are virtually no administrative constraints on independent irrigation works.

Across the river in Senegal, on the other hand, SAED has monopolistic pretensions. The village near Bakel saw its efforts absorbed into SAED, the villagers' protests notwithstanding.[72] The obvious imperative of ceding control of even independent efforts to SAED, and subordinating localocentric development objectives to national development goals, will doubtless discourage further attempts at autonomous development on the Senegalese banks of the Senegal River.

What expectations can be held whereby land holders will deploy access to small-scale works in their overall subsistence strategy? How will they use small-scale works coupled with their present resources to give themselves advantage?

Adherents join irrigated agricultural activities in an attempt to diversify production because the additional security that accompanies such diversification is more important to them than income. For that reason, they are unwilling to commit themselves wholeheartedly to irrigated production as a commitment would be a betrayal of their most cherished interests. The participants are reluctant to put all their eggs in one basket.

Participants can, therefore, be expected to cultivate only seasonally in even small-scale works, especially in the beginning before the works have proven their productive

potential. Participants on the small-scale works in the area of Bakel, Senegal, habitually neglect irrigated cultivation in favor of rain-fed agriculture during peak periods of work in their rain-fed fields. "On the small perimeters competition for labor time between traditional and irrigated crops, especially during the peak periods, affects the surface areas cultivated as well as yields."[73]

It cannot be expected that people will devote themselves full-time to even the small-scale perimeters; they will still want to tend their cattle; they will want to maintain other fields under cultivation; they may want to fish. The small-scale works can be called successful if cultivators reimburse the administrating agency for the amortization and operation of the works, if the rates of outmigration in the villages affected by the works drops, and if village activities undergo little change in times of climatic crisis such as the continuing dry conditions of the Sahel.

The experience of SAED with small-scale works has been very encouraging. There is considerable conflict between SAED and the peasants in the Bakel area but productivity was officially 3.5 metric tons of paddy rice per hectare in the 1976-77 season. This is almost exactly the average productivity per hectare of all SAED's works,

large-scale and small-scale. The other site of SAED's concentrated small-scale works in Matam had 5.18 metric tons in paddy rice per hectare in the 1976-77 season. Only the Dagana perimeter, a large-scale operation worked under intense mechanization, could claim a higher average yield per hectare that season. Whereas the average rate of debt reimbursement for all SAED's perimeters (1976-77) was 37.7 percent, the peasants of Matam gave SAED an 86 percent reimbursement and those in Bakel did better than any others with a 99+ percent reimbursement rate.[74]

SAED's small-scale works do not occupy the cultivator full-time and he is given, on the average, only a 1/4-hectare plot per year. The yields are good to excellent, but the plot is so small that, after debt reimbursement, very little rice from the small-scale works finds its way into the national market. SAED evaluated the rate of commercialization of rice from the Matam area at around 5 percent of production and in Bakel as practically non-existent in 1976-77. Overall, SAED commercialized about 39 percent of the rice produced in its works that year,[75] but it must not be forgotten that SAED goals are national development goals and localocentric development is incidental to its program and the low rate of commercialization of rice grown in the small-scale works is a severe drawback from its institutional point of view. For that reason, SAED has come

to look on development of small-scale works as initiating the tenants gradually and in a fairly congenial context to the requirements of irrigated agriculture on the road to adoption of large-scale works.[76]

Given the predilection of national institutions for a policy focusing on development at the national level, is a localocentric approach to development a feasible alternative? Objections to a localocentric approach will be raised by those having an interest in an approach that centralizes the development of all the localities of the state and fits them into some national institutional scheme. The most serious objection to a localocentric approach will be that it is strictly a local phenomenon. It does not supply the urban populations, and it does not permit the nation to extract any surplus for investment in development projects in other regions. A further problem is the impact which a localocentric approach would have on the administration, the largest corporate group with interests to protect in the Sahelian countries.

It is true that small-scale schemes will benefit the urban consumer less than do the large-scale schemes, in terms of domestically grown produce. At the same time, however, a reduction in the subsidies necessary for large-scale schemes will free national treasury funds for investment in urban-

oriented programs. The rural-urban migration tide may abate if rural life becomes more secure and certainly, security from the adverse effects of drought in rural areas will relieve the national government from a great care. All of these benefits will compensate the urban poor for relinquishing the security of domestic, staple food production in favor of continued imports and a continuous drain of foreign currency reserves.

The drain in foreign currency reserves is often cited as a justification for a development policy (often represented by large-scale intensification programs), geared to import substitution. The savings in foreign exchange, however, from the consumption of food staples produced domestically, melts away when the foreign exchange costs of imported machinery, expatriate personnel, and repatriated loan installments and interest charges are taken into account.

It is also true that localocentric development projects make the appropriation of beneficiaries' surplus for investment elsewhere very difficult for the administration; but strong resentment is brewing against the administration's current appropriation policies in the Sahel because of the present level of well being in large-scale projects. It has been very difficult for the administration to transfer a surplus from a given project to other governmental operations although it has been done.

The administration will be reluctant to see a change in development policy requiring less administration rather than more because the change threatens security and staff personnel; however a shift to localocentric development will not threaten the livelihood of those staffing the administration. A shift will simply mean the decentralization of certain operations and a change in emphasis. Financial administration will be de-emphasized; extension training and services will expand dramatically; logistic services will have to adapt to the dispersal of their constituents and power will flow from a centralized monolithic administrative organization into authentic autonomous local cooperatives. The centralized administrative organizations will have to remain, at least temporarily, in order to coordinate the services, though attenuated, that it will offer the villages.

There are several advantages to the small-scale agricultural intensification project which no Sahelian government can afford to overlook. OMVS (Organization Pour la Mise en Valeur de Fleuve Senegal), a multi-national organization charged by its members with coordinating the development of the Senegal River, reports small-scale projects have a higher internal rate of return, 18 percent, than large-scale projects, 10 percent.[77] Projects making use of local village

labor, are also more economical to construct and, consequently, easier to finance.

> "In fact, as SAED experience shows, the participation of villagers substantially decreases the development costs and considerably increases the internal rate of profitability of the small perimeters, which can easily be financed by foreign services."[78]

OMVS concludes, "Development centered around villages makes it possible to maximize the use of labor and hence makes the population the actual development agent.[79] The presence of small-scale works dispersed throughout the area will also mean a granary accessible to rural dwellers and will obviate the expensive and time-consuming necessity of importing and distributing relief supplies from overseas.

It is impossible to predict whether or not the proposed development of small-scale works will be accepted by the central administration. Discussions toward this approach and its acceptance are worth embarking upon, however, and a cogent argument, from an economic point of view, can be presented in support of the small-scale intensification scheme approach.

Recommendations

It is of the utmost importance to concentrate on the concrete goals of the project during project design. Increasing local population benefits means giving the people the ability to live a more secure material existence. The successful attainment of this goal will be measured by the stability of the local population in the village, by its health, by its ability to withstand the hardships that undercut the well-being of those in the region outside the project and by its record of financial contributions to the maintenance of the works.

Since the scale of the project affects the probability of successful attainment of project goals, large-scale agricultural intensification projects have been contrasted with small-scale projects. The distinction is not discrete, but there is, however, a tendency for projects to be grouped into one of these two modes.

Large-scale projects can cover vast surfaces although some of the perimeters in the Senegal River Delta contain only a few hundred hectares. A more important diagnostic trait than raw surface area, is the factor mix employed in land improvement and preparation for production. A large-scale project requires graduate engineering design expertise and heavy machinery for construction. The works are generally

technologically refined which requires heavy capital investment. Only with the acceptance of the capital-intensive approach to development can questions of economics of scale intervene. The UNDP/FAO report advocates perimeters of over 7,000 hectares in order to facilitate administration and support.[80] The perimeters are constructed on extensive more or less level surfaces, containing homogeneous soils usually high in clay content, in order to permit the efficient use of irrigation waters. The soils are usually so heavy that the tenant must acquire a team of oxen, or must hire mechanical cultivation services from the administrating agency, in order to work his plot.

Small-scale projects cover much smaller surfaces, varying from the one to two hectare plots of the OPI/API program in the Upper Senegal Valley in Mali, to the 40 hectare range of many of the Senegalese village perimeters. Again, the most important diagnostic trait is not raw dimension, but the way of underwriting development.

A major component in building a small-scale project is the investment of labor from its intended beneficiaries. Perimeters are constructed near villages or in areas where there are high population concentrations, on level often elevated ground with restricted surfaces of lighter, sandier soil than that found in the natural bottomlands which better

lend themselves to improvement on a larger scale. These conditions enable cultivation of small-scale projects with a minimal modification of the technology to which the participants are accustomed.

The major advantage of small-scale projects is that the requirements of economic viability weigh far less heavily on the participant than in a large-scale project and he can discharge his responsibilities to the administrating agency in much less time, using his free time to pursue other interests. If the small-scale perimeter is productive, it can be expected that the participant will grow an off-season crop and vegetable gardening has become an extremely common off-season undertaking in Sahelian areas where water is available for off-season cultivation. Large-scale works, with their heavy financial burdens, can ill afford the cultivation of forage for local cattle but a substantial portion of small-scale works can be devoted to forage cultivation, if the participants express an interest. The cultivation of forage will permit the maintenance of herds near the residential areas of small-scale works, giving continued access to cattle products which are a major constituent of many diets. It will also largely sidestep the problem of desertification of outlying areas and will be a force encouraging sedentarization of pastoral activities.

When the concept of irrigated development is accepted, the problem becomes one of realization. The author recommends two separate but converging strategies. A donor agency, from national or regional offices in the Sahel, can determine the sites most conducive to small-scale irrigation projects from a technical point of view. The criteria of site selection are proximity to a population concentration, a level terrain, good soil quality, proximity to water, feasibility of perimeter development by human labor, etc.

The donor agency will, at the same time, need field agents who can transmit an understanding of the requirements to the potential beneficiary villages, and who will transmit expressions of interest back to the donor agency. The most appropriate field agents may be, in the case of US/AID, local Peace Corps volunteers. AID will need sensitivity, understanding, a willingness to underwrite aspects of Peace Corps programs relevant to its concerns and a willingness generally to extend a helping hand to volunteers. Peace Corps/AID collaboration would be far more productive than the ad hoc cooperation that is presently active in some countries.

AID should delegate one of its staff members to begin negotiations, accompanied by the Peace Corps volunteer who had made the initial contacts with the village, and a

representative from the host country government body responsible for the administration of the completed projects.

Preliminary discussions will make clear that serious negotiations cannot take place until the village can present a corporate body, or cooperative, empowered to deal with all questions relating to construction, administration and maintenance of the works. Extension services to help organize must be made available to the village but, the donors should interfere as little as possible, simply requiring equality of access to all village residents and the right of women to cultivate either as members or in a separate women's cooperative.

The requirements of the host country government and the donor agency will be translated by the Peace Corps volunteer into the village idiom. After the broad outlines of project objectives and the role of the village in realizing them are understood, and when the council or cooperative is formed, serious negotiations can begin. The donor party must detail what it will furnish and what it requires from the village in return. The village irrigation body must repay the donor in kind, over a period of years, at a given rate, and will also be responsible for supplying the labor for construction. The village irrigation body will determine water allocation and a schedule and terms for works

maintenance. The donors will supply, subject to village council acceptance, extension personnel, to advise on all these matters as well as the technical questions of cultivation and financial accounting.

Competent advice is essential, but it is imperative to keep the requirements of the donor party to a minimum so that the village irrigation body will have latitude to determine its course. In case of disagreement between the village irrigation body and the extension service, the extension service must consistently base its argument on the need of the donor party to recoup its investment, but both the extension agent and the donor party must be willing to let the participants make their own mistakes and determine by their own experience the most advantageous use of the works. If the participants are unwilling to accommodate their use of the small-scale works to the limited requirements of the donor party negotiations should reopen to determine the reasons. The donors must be prepared to abandon the works altogether if they are not properly maintained, if there is endemic conflict in the village body hampering productive activity, or, if the village irrigation body is consistently unwilling or unable to meet its financial obligations to the host country agency responsible for the administration of the works.

The donor and the host country administration must both be willing to tolerate apparent inefficiency in the exploitation of the small-scale works; for example, cultivation in only one season where cultivation in two or three are technically possible, or cultivation of a crop that has a lower market value than others that are technically possible. However, as long as the works are maintained, the debts paid and relative peace reigns, no criticism should be leveled of the operations of the works because, over the long term, it can be expected that the participants in the small-scale perimeters will arrive at the optimal exploitation of the works.

The quarter hectare share, common in the SAED village perimeters, may be adequate for each family's share in the beginning. When villagers decide a larger share would be advantageous, negotiations could be reopened following the guidelines of the original construction. Expansion depends on the villager's assessment of the impact of increased irrigated cultivation in the local economy, and may take one year or never happen.

It is the responsibility of the donor's technical staff and the host country administration to design the works, in consultation with the village irrigation body. Since it will be hard for members of the village irrigation body,

unfamiliar with such installations, to visualize the works in the design stage, the designers must be prepared to accommodate demands for significant revisions, especially during the early years of operation.

Hochet, digesting the experience of irrigated perimeters along the Senegal River, has proposed a set of principles for designing the works:[81]

1. Mastery of water is the pre-eminent consideration. This requires a fairly dense network of secondary and tertiary canals feeding all the plots in the works and a diesel pump to transport water from its source into the hydraulic network.

2. It is important for plot-holders to be able to move about the works easily as no one likes to trudge through twenty-five yards of calf-deep water on a chilly December morning for some indeterminate cultivation operation on his rice crop.

3. Each family unit must be able to exploit its share of the works independently.

4. Participation in irrigated cultivation must be of clear benefit, either in terms of cash income or, in terms of increased family food.

5. Labor-intensive cultivation is far preferable to mechanized methods because the cultivator is more fully

occupied and he is able to control a larger share of his production if he and his family produce it by their own effort. OMVS estimates that production of a hectare of irrigated rice requires 175 to 200 person days of work under labor-intensive methods. Under the heavily mechanized methods generally employed by SAED in its large-scale perimeters, 40 to 80 person days of work are required to produce one hectare of irrigated rice.[82]

6. The appropriation of village lands for the creation of an irrigated perimeter threatens the property holding relationships of the villagers, and special attention must be paid to this problem in negotiations with the village irrigation body. Control of the perimeter lands must be vested in the village irrigation body during operations to minimize local insecurity; however, land-holders will often voluntarily relinquish their rights since a share of the improved land within the perimeter is often worth more than a larger area of lower productivity.

7. Families should be grouped on adjacent plots dependent on the same secondary canals of the hydraulic network, thus maximizing cooperation and minimizing conflict.

8. A good extension program is essential for successful operation of the works.

9. "If irrigation projects are to become viable, only about 20 to 30 water users should be included in the farmer groups involved in managing a water delivery system. Projects involving more farm families will require a more sophisticated layered management."[83]

It would be helpful to have a regular liaison between the village irrigation body and the donor relying possibly on Peace Corps volunteers specializing in rural agricultural development who could make a valuable contribution to the success of the program.

Negotiations with the government agencies of the host country must reach their conclusion before the first village contacts are established. The host country government, like the donor, must limit its intervention in the operation of the village irrigation body. Agreement must also be reached on the services the host country will supply to the village irrigation body and the cost to the participant. The duties of the participant in terms of crops he cultivates, schedule of his field activities, the marketing of his surplus, production, etc., must be acknowledged by all parties but the host country administration must also allow the village irrigation body wide latitude in directing its affairs.

Further construction of large-scale projects should

always remain an option but design and construction should proceed only when rural food supplies have been assured, with the help of small-scale village perimeters, and when the production in the large-scale perimeters becomes competitive with the world food markets. Food production for domestic consumption, at any price, will only sap the strength and resilience of the local economy.

FOOTNOTES

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48. Barnett, op. cit., p. 75. Values for the Sudanese pound have been converted to dollar values at 1 £ S = $2.55.

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VI. COOPERATIVES, INITIATIVE, PARTICIPATION AND SOCIO-ECONOMIC CHANGE

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Socio-Economic Change in the Sudano-Sahel

The two dominant and contrasting perspectives for examining socio-economic change in the Sahel are "modernization" and "dependency".[1] These are not exclusive but they lead to very different emphases, analyses, and conclusions. Modernization appears to be the dominant mode of analysis at this point in mainstream social science. Modernization emphasizes the notion of social and cultural barriers to development. In the case of the Sahel, emphasis is given to why the peasants and herders have resisted change and remain conservative. Sahelians are looked at as having been traditional, and being tardy in becoming modern. The solution then is to make or lead Sahelians to become modern. In shorthand form, the way to do that is to open up all of the

Sahel to the market economy. In the words of Caldwell "...the need is for rapid economic development with an opening up of rural areas to the full market economy" (1975:61). Development in this perspective is not possible without massive amounts of foreign aid and assistance. Change, in the modernization perspective, is beneficial or at worst benign. Development becomes the synonym for progress. After all, the Sahelians (and others) were much worse off in the past, and now they are at least seeing, if not actually enjoying, the fruits of the modern world. Change often becomes something only recently introduced. The weight of how change occurs focuses upon the colonial and post-colonial periods and not upon the precolonial past. In addition, change is seen as exogenously introduced to basically traditional, non-changing, non-progressive societies. In this view history plays only a small or insignificant role in determining the current outcome of development efforts.

Two other points can be linked to the modernization perspective. First, the colonial period constitutes the conditions for genuine progress or development. Colonialism breaks down the earlier isolation, introduces modern medicine, education, and despite its excesses leads to the possibility of real development. Second, those people who do not become

market and economically (narrowly defined) oriented are described or characterized as irrational. Sahelians then are viewed all too often as obstacles standing in the way of economic advancement - an economic advancement which somehow is to be to their advantage. Those who do not partake of economic rationality, that is of a market mentality, are seen to be irrational, conservative, and opposed to development. In this perspective, rural economic change stems from colonial and postcolonial interventions in the rural arena. Rural inhabitants, first called tribesmen and now called peasants, along with herders and/or pastoralists are seen as committed to an outdated mode of existence, one which can be altered through integration into a national political structure and economy. In turn, the national structures are integrated into world structures. Underlying concepts of modernization, and how change takes place in the Sahel rests both the assumption and conclusion that development takes place along a linear line, and that the process in the Sahel will at least in principle repeat Western experiences of development.

It appears that those who hold the modernization view believe that the changes introduced into the Sahel during the colonial period did not fundamentally alter the Sahelian economies, otherwise why label them traditional? And it

certainly is an article of faith that change can be planned and consciously implemented.

There are alternate perspectives to modernization. These include a critique of modernization but without suggesting an alternative view (except by implication) or alternative views of both the past and future. The starting point of most anthropological and sociological critiques of modernization or the modernization path toward development commences with the idea that there are a wide variety of socio-cultural factors that could facilitate development. One should not stop analysis by looking only at specific value orientations which are seen to be necessary. As Norman Long has written (1977):

> "If, however, one adopts a more eclectic standpoint and recognizes that there are many varied outcomes to economic growth and different modes of organizing the pattern of development, then it would seem that a wide range of contrasting value commitments can serve as facilitating cultural ideologies." (68)

The implication is that there are a variety of ways toward development, and that one would expect to find great variability in the responses of rural peoples. In the case of the Sahel, we will discuss some of these below. At the same time, as one questions whether there is any single outcome of development processes, the notion of traditional needs to be re-examined. Typically traditional implies that the

societies have existed in equilibrium. But in the case of the Sahel, as elsewhere, many striking features of what are labelled traditional societies emerged as a consequence of the changes introduced by colonial rule. There is a different view of history involved, and how history affects the present. In my perspective, Sahelian societies have been consistently changing. It is only when we have more up-to-date historical studies of the Sahel (although there are already many excellent ones) that we can detail the different historical periods and their defining characteristics. Change can no longer simply be exogenous. There are forces of change internal to the Sahel, and to the societies of the Sahel, as well as exogenous ones.

The modernization approach, or dualistic view of Sahelian nations, plays down the form and content of integration into West European nations. At the same time, the original poverty of the Sahel needs to be questioned. Poverty has not been a permanent condition of the peoples of the Sahel. Subsistence societies are not synonymous with poverty.

> "Le fameux equilibre traditionnel avait tout de meme une certaine efficacite. Ce n'etait certes pas l'age d'or, et les regions saheliennes et soudaniennes ont connu des penuries alimentaires plus ou moins graves, plus ou moins longues. La disette recurrente existait independamment des facteurs externes. Mais les ethnographies du

> present mi-precoloniales mi-coloniales insistent rarement sur la logique des structures socio-economiques precapitalistes. Les populations survivaient, mais ne connaissaient pas la des-integration sociale que les nouvelles conditions de production pour le marche ont imposee pro-gressivement ou violemment." (Copans 1975: 31).

There were poor people in the Sahel prior to colonialism, but only relative to their own societies; in particular, slaves were often quite poor. However, the lack of material possessions does not necessarily mean a condition of poverty; rather, it is the relationship between means and wants. If there were a balance between needs and wants, it would be hard to sustain the proposition that the Sahel was poor. In addition, there is evidence, both historical and anthropological, to indicate that the relationship between population, resources, and trade led to a higher precolonial standard of living than that of the colonial and postcolonial periods. The current stagnation in food production, aside from the effects of the drought, indicates a serious decline in availability of basic foodstuffs to some rural populations, below that known in the precolonial periods, and it is the contention of some anthropologists and historians that there was a more balanced relationship between humans and their environment prior to the colonial period.

In this second view, the underlying paradigm is "dependency theory." The Sahel, in this perspective, does

not constitute an underdeveloped region, (although perhaps a 'backward' one) until the colonial period. The degradation of the environment and the decline in the standard of living either begins or intensifies under colonial rule. It is not a necessary part of this argument that this was a conscious policy of the colonialists, but rather an outcome, if often unforeseen, of colonial policies.

Both modernization and dependency perspectives point to the market, and to market relations, as being the prime factor in the institution of economic changes in the Sahel. Claude Raynaut sees the change from a substantive to a market economy. In the shift and breakdown of the economy comes agricultural decline and stagnation.

> "...through the breakdown of the fabric of society, collective control over material conditions of life has been taken away. The end point of the production and circulation of goods is less and less the satisfaction of needs linked to subsistence and the functioning of social groups, but more and more the acquisition by individuals of the money of which they have such great need." (1977:20).

The disintegration and disarray of the rural societies of the Sahel can be explained by the monetisation of the economy. For Raynaut subjection to external domination, and the diversion of the ends of the economy constitute the forces for change in the Sahel. This is in marked contrast to the modernization view, whereby, the market is a progressive force

leading to better conditions and the amelioration of standard of living.

There has been a continual process of change in the Sahel, of which the colonial period was of a particular form. There are the differing conceptions underlying the understanding of change which lead to different conclusions about both the nature of the Sahelian crisis and its implications. But the overall point remains that the Sahel has never been an unchanging area. This can be shown through the nature and form of the trans-Saharan trade for which many Sahelian cities were important entrepots, through the introduction and spread of maize cultivation, and through major political developments which had important economic consequences, such as events in the interior delta of the Niger in Mali, and micro-adaptations by the hundreds of Sahelian societies to major and minor environmental variations, including variations in rainfall. Other examples of incremental change are the increased use of animal manure for the fertilization of fields, the elaborate codes developed by the interaction of herders and farmers for the balanced use of areas for farming and herding, the development of flood agriculture in the river valleys, et al. In sum, there were vast, if often slow, changes in the Sahel, one of which might indeed be called a revolution -- the development of pastoralism, and the spread

of pastoralists through the more northerly Sahel where other cultural adaptations were less possible. The institutionalization of these changes is less well documented than more recent ones.

It is important to note that many of these changes came about without market incentives and without market relations. Other aspects of the institutionalization of change, the slave trade both with the north and the trans-Atlantic slave trade, the intensification of the use of slaves in the Sahel, and then the end of the Atlantic slave trade, and the beginnings of what is called "legitimate commerce", have been subject to very high quality, recent, historical research (see Hopkins, Curtin, Meillassoux, Meiers and Kopyotoff), and has raised much controversy concerning the form and structure of indigenous African economies. No one is, however, suggesting that they were stable, unchanging, or non-responsive.

While it can be argued that the colonial experience is no longer relevant in terms of understanding the Sahel, it remains important, and, the understanding of the kinds of economic change that were instituted during the colonial period, provides the basis for an assessment of how change has taken place, as well as for what changes are required. The colonial period was one of externally induced change,

some of it voluntary on the part of Sahelians, some of it involuntary, but in general, having consequences which could not have been anticipated. The most important changes were externally induced during this period. In more global terms, the evolutionary trajectory of West Africa was decisively altered by the colonial period. As Hopkins observes:

> "What happened to Africa was part of a global confrontation between the developing and the underdeveloped countries in the nineteenth century, though the nature of the interaction between them, and its outcome, varied in different parts of the world. The economic expansion of Europe in the nineteenth century had a profound and destabilising effect on West Africa because it changed the structure of export production and involved the region in the trade cycle of the new industrial economy." (1973:164).

The Sahel was relatively isolated from some of the major economic developments in West Africa, but, events further south were to have great impact in the Sahel; for example, the development of cash crops, particularly peanuts, and the expansion of agriculturalists to the north. Sahelian patterns differed because of pastoral adaptations, lower agricultural yields, and perhaps most importantly, difficulty in developing the profitability of the Sahel. Several anthropologists (Meillassoux, Raynaut, Copans, Samuel) suggest that the Sahel served primarily as a labour reservoir,

an area where labor could be drawn to underwrite colonialism and its projects. As Raynaut has put it:

> "Unlike other areas of Africa, blessed with great natural resources, the poverty of the territories of the Sudano-Sahelian belt, and the risks inherent in agriculture there, have never allowed direct exploitation to be sufficiently profitable for any interest to be shown by colonists from the Metropolitan power. The only aspect of 'profitability' which could be used by the colonial power - considered from the twin standpoints of politico-administrative power and commercial return - was to extract the maximum from the only wealth available: the labour of local populations." (1977:20-21).

Sometimes the colonial policy practiced in the Sahel and the Sudan can be described as acquiring the surplus product of the peasant, without destroying the domestic or peasant mode of production. The levers of change were forced labour, forced cultivation, forced delivery of products and taxation. This is not to say that there weren't other factors of change (i.e. increased population of both animals and humans, shifting religious preferences, et al.) nor, that these changes were wholly negative. This is why the Sahel appears to be so "traditional". The colonial impact appeared, at first, to be less destructive by leaving the domestic economy intact, while at the same time permitting the African distributive system to intensify and to be sustained. Hopkins (1973:244) has shown how the internal trade survived and expanded during the colonial era in West Africa.

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He points out that this is not intended as a defense of colonialism:

> "but rather as a tribute to the skill and adaptability of Africans at a time when unprecedented demands were being placed on indigenous production and marketing arrangements." (244)

Thus, while the major forces for change in the latter part of the nineteenth and first part of the twentieth century have been external, this does not mean that Sahelian agriculturalists have been passive or have remained stable. Brokensha, Horowitz and Scudder (1977) have emphasized this even further for the pastoralists. They write:

> "There is no stable set of behaviors, no invariant set of behaviors, no invariant set of practices, no 'millenia-old customs' which characterize contemporary pastoral life in the Sahel. Apart from the ethnic and historical complexity of the region, which gives rise to a broad range of inter-group differences, the twentieth century has seen a series of changes introduced into the region to which the region responded. The ability of the people to respond, to experiment, to innovate has been documented again and again in the ethnographic literature which underscores the dynamism and opportunism of pastoralists rather than their stability and boundedness." (18)

Brokensha, Horowitz and Scudder locate the major change factors in the political arena, colonial rule and then independence, and in the economic-modernization and development. Modernization and development includes improved veterinary practice, permanent sources of water and the dependence of some nations upon the export of meat to generate national revenue.

The degree to which environmental degradation can be viewed as a major cause of social and economic change is controversial. Brokensha, Horowitz and Scudder argue against the notion that pastoral practices have led directly to environmental degradation. This conclusion is supported by others, including Jeremy Swift and the French geographer Toupet. Toupet maintains that it is the nomad in semi-arid zones who contributes to the conservation of nature. Contrastingly, sedentarists despite governmental preferences for them, have been far more destructive of the Sahel and have led to a rapid degeneration of the land (1975).

One colonial effort to incude economic change failed in West Africa as a whole; the effort to set up and maintain European or expatriate run agricultural enterprises. This is linked to the earlier suggestion that the domestic economy remained relatively intact during the colonial period. There were famous efforts at the establishment of such enterprises, particularly on the Senegal river beginning in the 1820s. Although different, the Office du Niger was one of the largest efforts to dramatically change the mode of agricultural production in this zone.

Efforts both on the Senegal and Niger rivers, instituted by the French, were aimed at the development of cash crop

productions, both the crop and the benefits to be for the metropolitan power. Thus, Marchal concludes his study of agricultural colonization of the Niger:

> "Malgre les declarations de principe, il en a ete ainsi a l'Office du Niger, cree pour satisfaire les besoins d'une metropole. L'Office est ne de considerations techniques. Il fallait profiter d'une circonstance a savoir 'l'eau coule toute seule', pour developper un centre de production cotonniere. Ce n'est qu'en second lieu, lorsqu'il a fallu rechercher la main-d'oeuvre necessaire a son exploitation, que les promoteurs ont songe au Mossi, au meme titre qu'aux autres groupes du Soudan. Les premiers responsables de l'office n'ont pas ete particulierement animes par la volonte de soulager les fortes pressions demographiques du Yatenga. La colonisation agricole a ete concue comme une colonisation de production. Ce caractere n'a fait que se confirmer a mesure que l'exploitation des terres irriguees s'est orientee vers des modeles de mise en valeur de l'organisation du pays developpes." (1974:90).

In contrast to the colonially inspired and directed projects, one finds the Mourides of Senegal (composed primarily of Wolof-speaking peoples) as another example of an African response to the opportunities of a new cash crop. Some of the same characterization that has been made of the Ghanian cocoa farmers, can be made of the Mourides:

> "The Ghanian cocoa industry was the creation of local farmers, responding to the opportunities of a new cash crop. Foreign owned plantations or foreign settlers played no role in this development. As shown most clearly by Polly Hill, the driving force was above all a stratum

> of rural entrepreneurs investing in land and labour, moving to areas where soils were most suitable and where land could be acquired through purchase or leases. They reinvested the surplus in new land and new farms, but also in transportation equipment and other complementary services." (Beckman 1976:37).

It should be clear that during the initial development of cocoa production, and until the establishment of the national marketing board, the trade of cocoa was handled by foreign corporations. One of the primary differences between the development of cocoa in Ghana and peanuts in Senegal, was the rapid growth in Ghana of a labor market and of capitalist methods of production. "The bulk of Ghana's cocoa was soon produced on holdings using hired labour on a more or less permanent basis. (ibid:38)".

A brief examination of the Mourides provides a case study of the complex interaction between the European colonialist and an African society as a successful adaptation to colonialism. The Mourides are a religious brotherhood based principally among the Wolof peoples of Senegal. They are a Sufi order, but unlike other religious movements, they have been tied to a very specific economic as well as religious relationship. The Mourides order is based upon a tie of dependence between a master or marabout also called shaikh and a student or talibe. The shaikh is an essential intermediary between the faithful and Allah. The talibe

gives both labour and products to the marabout. The key unit in the rural areas is the dara. The dara has a triple meaning: the place of religious education or the house of the teacher, the farm under the direction of the marabout, and a farming group of young men.

While there is not space here to detail the changes in Wolof societies and the beginnings of French colonial rule,[2] it is essential to point out the degree to which colonialism was disruptive of older patterns and the indigenous system of stratification. The basic kin groups of the Wolof, the extended family and clan, were undermined; the basis of political authority, warriors, was eliminated; the binding of chiefs to their clients was ended; and the economic support of the upper strata, slavery, was similarly diminished. In the varying responses to French colonial rule, there were those who demanded and used armed force against the French while others wanted an unarmed and subtle resistance to the colonists. The Mourides adopted the latter. The Mourides were founded on the basis of modifications in Islam, the charismatic position of Amadu Bamba (the religious founder of the Mourides), and the adaptation to part of the economic basis of colonialism. Beginning with opposition to colonial rule and meeting French resistance (1886-1915), the Mourides then spent a long period of

collaboration and cooperation with the French lasting until 1960; they then continued the same patterns with the new Senegalese government but it appears that the long period of cooperation, and lack of internal conflict within the Mourides themselves, is drawing to an end.

According to Cruise O'Brien, one of the major students of the Mourides:

> "The key to an understanding of the economic success of the brotherhood as a whole, and the saints in particular, lies in the organisation which the saints have provided for a mass movement of agrarian settlement. The Mourides, over the past half century or more, have established farming communities throughout a vast zone (thousands of square miles) of hitherto uncultivated land around the fringe of Senegal's central desert (the Ferlo). This massive agrarian colonisation has involved an evolution of social and economic organisation, from the original pioneer settlements to the constitution of economic communities." (1975:63).

The Mourides provided for the landless, the former slaves, the displaced "... the means of material survival - land - and in order to secure this land they needed organization and leadership" (1971:289) which the shaikhs provided. The French provided support as well in the conflicts with the Fulbe pastoralists, whose land became the site of Mouride expansion. The Mourides based their organization upon the cultivation and marketing of peanuts. However, despite their becoming cash crop producers, the basis of peanut

cultivation was not wage labor. Rather, it was a religious relationship whereby the cultivators (students, talibe) worked for nothing but the promise of obtaining their own land in the future.

Initially the dara (villages) were very difficult places with poor housing, little water, and needed a great deal of work in order to put the land into peanut cultivation. Gradually, through time, they became much easier places in which to live and work. The tremendous amount of hard work involved was felt not to be important for the talibe served the shaikh for the attainment of paradise. However, the material reward of land can no longer be carried out in the same way without threatening the vast fields and workers available to the Shaikhs. Thus, O'Brien observes:

> "Population expansion, and a consequent steady shrinkage in the supply of available uncultivable land, tend to compound the threat to the shaikh's domination. Lack of 'new' land may soon make it impossible for the Mouride leaders to compensate for the plots which must progressively be cut out of their present estates, as rewards for the faithful tak-der. Such a development would of course strike at the very basis of maraboutic economic dominance, menaced as it is by rapidly falling groundnut prices. Without land and without the cash revenues which land produces, it is difficult to imagine how, the shuyukh would retain firm control over their clienteles." (1971:299).

Fundamental socio-economic change transformed much of the interior of Senegal. In the absence:

> "of bureaucratic staff; the confusion of household and 'official' affairs; the haphazard nature of such written records as are maintained; the intermittent communications between the brotherhood's leaders: superficial observation of these 'weaknesses' may tend to convey an overall impression of organizational inefficiency to the European outsider. This is certainly no 'modern' organization, deliberately designed to achieve specific goals, with a power centre to review performance and substitute personnel where necessary." (1971:294).

In the case of the Wolof of Senegal, or at least of those who joined the Mourides, we find almost all sectors of the Wolof accepting profound economic change, that is change in the organization of production, and in the basis of that production. There were some sectors among the Wolof who resisted change and the reorganization of Wolof society, in particular those linked to the warrior strata or tyeddo. However, they were historically bypassed as the basis of the strength was taken on the one hand by the colonialists, and on the other by their legitimacy in the Mouride order and its new pattern of political relations and submission to the new religious hierarchy.

The case of the Mourides, while instructive, is not however typical of the Sahel. Two major differences stand out from the experience of other Sahelians. First is the production of the peanut as a cash crop. Most Sahelians retained a much stronger orientation toward basic subsistence

crops; second, the rise of a religious movement which reorganized the society, not only economically but socially and politically as well. Most other Sahelian groups did not undergo such a dramatic reorganization. But one should not overexaggerate the differences either; cash crops were introduced in all of the West African nations, if not peanuts, then cotton. And many Sahelians, if not directly involved in the growing of cash crops, were affected by the push of those from the south who were.

For example, a very different story, but nonetheless one marked by profound socio-economic change has taken place along the Senegal river, among the Tukoleur.[3] Others could be shown for the Tuareg[4] and for the Maures[5] (who are less well studied). While there are several longer term studies both of individual societies and of projections for the future, it is difficult to formulate generalizations about the kinds of changes that are or are not accepted by the differing, and changing, strata in the different Sudano-Sahelian societies. In my view, we need further in-depth studies like those suggested by Brokensha, Horowitz and Scudder. In addition, I suspect that the generalizations which can be developed for the late precolonial and colonial periods will no longer hold true for the contemporary postcolonial, and drought situation.

The triple crisis of economy, population and ecology is indeed something new and without historical precedent for the Sahel-Sudan. The current infusions of large amounts of Western capital combined with the form and structure of West African governments and how they respond to the triple crisis together with the responses of the peasants and herders can only lead to speculations and suggestions concerning the crisis.

Based upon the experience of other parts of Africa, let us then examine the degree to which the Sahelian peasantry has or has not been supportive of change. I focus on the peasants because all too often they are regarded, by both planners and government employees, as obstacles to change. The pastoralists' experience has been summarized by Jeremy Swift. There have indeed been great socio-economic changes in the Sahel-Sudan, although they may not appear to the casual observer, and observers tend to make ethnic or racial assessments of why some people or groups of people have become more 'modern'. I agree with Hutten and Cohen when they note that conservative and innovative behaviour occurs in all societies, and that at our present state of knowledge there appears to be no uniform pattern of resistance to chance, or acceptance of the new, which enables us to say who will resist particular

technological, scientific and cultural changes (1975:105). There is now a large volume of literature which documents the fact that peasants do make strategies and calculations, but that these strategies are based on different sources of information and consider different factors than those of economists or planners. Brokensha, Horowitz and Scudder (1977) call for a greater understanding of Sudano-Sahelian marketing systems. This would enable us to understand precisely how small producers, peasants and herders, respond to different incentives. To study only economic incentives leads us to lose what indeed are the determinants of social behavior. It is possible that the conclusions might very well correspond to those of Scott in his intriguing study of peasants in Asia, who rests his analysis on the peasant household as a survival unit.[6] Peasants give highest priority to the survival and maintenance of their household. In particular, Scott observes that the insecurities of the world market are much greater than those of local markets, or of non-market situations. He writes:

> "In a smallholding subsistence economy, despite its profound disadvantages, a peasant family knows that if the harvest is sufficient its food supply is more or less assured. When the crop is sold, however, or when portions of it are valued at current prices for rent or interest payments and taxes, there is no such assurance. The crop may be larger but a price fall will

> reduce its real value. To the extent that the market determines the value of the peasant's crop, to that extent is he exposed to the insecurities of the price mechanism. Taxes, rents, and interest paid in cash might cost twice as much in rice (emphasis in original) this year as they had last, even though the amount of cash required and the size of the crop remained constant." (58-59).

There is growing evidence that Sahelian peasants will be no different than peasants in other parts of the world. Peasants, of course, try to benefit from the market when they can, but the argument of Scott and others is that the structure of the world market, and often the manipulation of the market by national governments, operates to the disadvantage of many peasants. Thus, resistance to the market, and resistance to many development programs are, from the poorer peasants' point of view, rational. Or, if the goals and purposes of market participation are to keep things the way they are, then the strategies may also be quite rational. For example, Hopkins cites that peasant strategy in forming cooperatives in Mali. The implication of such a view, according to Raynaut, Hutton and Cohen (op. cit.) is to abandon approaches centered on the idea of the model farm or the progressive farmer. The goals of development ought to satisfy the needs of whole peasant communities, and not be only to the advantage of the chosen few. The peasants

may be more rational than thought if they are trying to avoid having their food supply be subject to the vagaries of the market.

Peasants show a variety of responses to economic opportunities as well as to economic disaster (i.e. the Sahelian drought); sometimes in a straightforward profit-oriented manner but more likely in a manner that cannot easily be classified as either impeding progress or facilitating it (Hutton and Cohen:105). In this situation then, a reanalysis of the composition of the Sudano-Sahelian peasantry is needed (that is, subdividing and classifying different sectors within the peasantry, within and between different ethnic groups). Only in this context will we move from the traditional framework to the modern, and develop a more processual approach to peasant responses.

One other dimension of rural social stratification that needs to be examined in greater detail concerns the historical legacy of slavery.[7] Already several studies demonstrate that slavery remains an important issue for the social organisation of labour, for participation in the local political systems, and for access to land. This is true of peoples of slave descent among the Tuareg, Maures, Soninke, Fulbe, and many others. Legal efforts to end servitude have occurred only unevenly. In many areas former

slaves do not own their own land and continue to work for, or rent from, landowners. In other instances they have some land, but not enough. Many, without access to land, join the stream coming to the cities, but of course all rural sector's members work in the cities.

Cooperatives in the Sudano-Sahel

A distinction needs to be made between cooperation and cooperative activity and cooperatives or a cooperative movement. All societies contain cooperation and cooperative activity with any degree of division of labor. The practice of cooperative labor has received relatively little attention in the study of peasant societies (Moore 1975). It is not useful to link all forms of cooperation under one rubric of cooperative as Seibel and Massing have done (1974):

> "A cooperative is here defined as a voluntary, open, and permanent association of equalitarian [sic] structure in which the members secure for themselves certain economic interests through communal self-help." (45)

Their view is that almost all African societies have cooperatives, or at least in their terms, the "tribes" of Liberia.[8] From their general definition they specify that there are different kinds of cooperatives. Thus they distinguish work and savings cooperatives among the rural peoples. A work cooperative is defined as, "... a group of farmers who

work in turn on one another's farms. Distribution of labor services rendered and received is based on strict reciprocity."(49) While it is possible that cooperatives can be based upon an egalitarian or reciprocally-based society, this is, in fact, very rare in the contemporary world. In particular, there are virtually no egalitarian societies in the Sahel. The division of labor during the later precolonial period in almost all Sudano-Sahelian societies was hierarchically organized. Work and the productive process were marked by a strong hierarchical division of labour involving slave and free labour, male and female labour, young and old, ethnic specialization and artisans. (The case for Liberia is somewhat different by the nature and form of the precolonial organization of Liberian societies.)

Seibel and Massing's notion of openness has been challenged by Widstrand (1972) and others for East Africa. In East Africa it has been argued that work groups in traditional societies were too small to form modern cooperatives, and that the work groups were not open ones. Further, the notion so strongly emphasized by Seibel and Massing among others, including Senghor, Dia, and Nyerere, that the traditional or communal forms of organization of precolonial Africa can be used to form modern cooperatives, has been disputed by Worsley (1971), Gosselin (1977), Gagnon (1976), Hyden (1973), Nash and Hopkins (1976).

The significance of the cooperative movement cannot be overemphasized even though cooperatives have not been particularly successful. Cooperatives gain their significance from efforts to control one's own social forms, and to emphasize and develop cooperative behavior. Cooperatives are an effort to mold the future. But cooperative systems always retain an ambiguous character and are both a type of production organization and a social movement with a socialist cast. While cooperatives have been used to integrate peasants into a capitalist or modern system, they are also supposed to be organized on a different basis than capitalist enterprise, in principle, based upon formal equality of cooperative members, and internal democracy. There is, however, a difference between cooperatives in Africa, both East and West, and those that have developed in Europe and the United States. The crisis that led to the formation of cooperatives in Europe appears to be different than the crises that have led to cooperatives in Africa. In both cases, though, there is an implicit critique of the status quo, and of the direction of society. The degree to which cooperatives form part of the status quo then becomes an issue within the cooperative movement. The degree to which cooperatives actually function and work according to cooperative principles, will then be in conflict,

more or less, with those who hold power (one might add whether in "socialist" or "capitalist" nations). Both these conflicts are part of cooperative history and practice in West Africa.

The vision of cooperatives in West Africa was perhaps best expressed by Mamadou Dia, in his early study and plea for cooperatives. He wrote in 1952:

> "Je crois...a la possibilite d'elever techniquement l'Afrique au niveau du monde moderne sans detruire la civilisation propre et la type d'economie qui en est le substratum. La cooperation permet precisement d'agir sur l'economie africaine dans un double sens: d'abord en lui restituant son veritable visage: d'economie de traite a laquelle elle a ete reduite, ella pourra en faire une economie autonome tournee essentiellement vers la satisfaction prioritaire des besoins du monde africain; d'une economie scelerosee, elle fera une economie vivante et feconde, capable d'expansion economique sans danger d'appauvrissement pour le producteur. En second lieu, la cooperation permettra la regeneration et l'adaptation des techniques nouvelles. Agissant directement et du dedans sur les structures, elle assurera la transformation de l'economie dans le sens d'une evolution normale des institutions traditionnelles." (58-59).

Dia argued that the cooperative form of organization could lead to the preservation of what was best (and natural) to African societies as well as to genuine economic development. The economic development of Africa in general, and of Senegal in particular, could be done only with the full participation and support of Africa's rural masses, whom Dia referred to as peasants. (In itself an interesting and

significant advance over earlier characterizations of African rural populations as tribal.) The notion that Africa was communal prior to colonial rule was also argued by Leopold Senghor:

> "La societe negro-africaine, elle, met l'accent plus sur le groupe que sur l'individu, plus sur la solidarite que sur l'activite et les besoins de l'individu, plus sur la communion des personnes que sur leur autonomie. C'est une societe communautaire." (1961:122).

Cooperatives were formed in Senegal for several reasons, including the key idea that they were consistent with the fundamental structures of African societies. In addition, they were to increase peasant productivity, and to incorporate the peasantry into the national economy. However, there was tension between the views of Dia and Senghor as to the purpose of cooperatives and as to the degree of democracy and decentralization they contained.

It is possible to detail how collective work (not cooperatives) was carried out in some areas prior to colonial rule by examining the different monographs on Sudano-Sahelian societies and specifying their economies and the organization of work. In addition, recent historical work has begun to clarify the form and structure of Sudano-Sahelian economies prior to, and during the colonial period.

Cooperatives, as a specific form of organization, were introduced to Africa initially by the French and British.

In the case of former French West Africa, they were introduced by the colonial administration and did not develop spontaneously from African farmers and peasants (as was the case in some parts of East Africa). Camboulives (1973) makes the significant point that the French colonial experiences did help form the contemporary cooperative structures because:

> "...le mouvement cooperatif est l'oeuvre des gouvernants et non de l'initiative privee, ce qui la differencie et l'oppose a la cooperation classique europeenne dans laquelle la realite promue par les particuliers a precede et conditonne les institutions." (14)

According to Hyden, the French set up cooperatives without giving a role to cooperative members. They were run as just another branch of the government bureaucracy from 1910 until 1950. The first cooperative groups to be formed were <u>les societes de prevoyance</u> whose purpose was to assure the economic development of the colonies and to promote the social well-being of the masses. These began in 1910 but were modified again in 1915, 1919, 1923, 1933, 1936, 1937 and 1938 (Camboulives:16). They were not insignificant in Senegal where in 1952 there were fourteen societes de prevoyance with 1,110,968 members (Camboulives:21). They were also significant in Mali, Niger, and Upper Volta.

The role of the Societes de prevoyance were, according to the decree of June 29, 1910:

1) "constituer des approvisionnements de graines en vue de pourvoir aux semailles, aux epoques convenables;

2) acheter pour les societaires les instruments agricoles indispensables et leur en faire l'avance a titre de pret;

3) venir en aide en cas de necessite a leurs adherents atteints par la maladie et les accidents;

4) les premunir contres les consequences de la secheresse, des inondations, des epizooties et autres fleaux naturels." (Camboulives:20)

Camboulives, among others, in summarizing the weaknesses of the Societes and why they failed, has pointed out that the Societes neglected their role as a promoter of co-operative activities in order to focus on commercial activity. In addition, their hierarchical and authoritarian organization prevented the members from participating in the Societes. Members were obligated to belong and to pay fees as though they were just another tax instead of genuinely participating.

The anthropologist Raynaut, (1975) in his study of the Hausa of Niger, has been highly critical of the Societes' role with respect to grain storage. He notes that the French administrators paid no attention or respect to indigenous methods of grain storage and preservation. They insisted instead, on central storage in conditions which

were worse than those previously used and, in the eyes of the people, placed the grain in the hands of illegitimate authority. After World War II, with a new government, principles of the cooperative movement already begun in France were applied to the colonies. The most important cooperatives begun in Senegal were based upon peanut production but they failed for a variety of reasons, (see Dia, Camboulives and Gagnon for the reasons) and were terminated by a new decree in 1955. The new law created special organisms for the creation of new cooperatives and their economic and technical support. Two new public services were created to oversee the reorganized cooperatives. The first was the Service d'assistance technique aux cooperatives, which was to provide technical and administrative assistance to promote the cooperative movement. It was supposed to be gradually replaced by a union of cooperatives. The other new agency was Les Societes mutuelles de developpement rural (SMDR). These two new agencies were to gradually replace the Societes de prevoyance and had a double mission; to assist the cooperatives commercially and financially, and to promote cooperation. They did not, however, fully replace the S.P.'s. Gagnon summarizes:

> "La S.M.D.R. est devenue l'institution dominante en milieu rural: en effet l'ensemble de ses taches, regroupees en trois secteurs principaux, l'accroissement de la production, l'ecoulement, les services et le credit, en font un organisme polyvalent ayant jurisdiction sur toute l'activite economique du paysan: ce dernier y appartient obligatoirement par une cotisation percue en meme temps que l'impot. Grace a ces contributions, auxquelles s'ajoutent des subventions gouvernmentales, des emprunts et des produits d'operations, la S.M.D.R. dispose pratiquement de la totalite des ressources financieres de son territoire; elle manque cependant souvent de l'equipement technique et humain necessaire a l'accomplissement efficace de ses taches et sa gestion compatable accuse presque toujours d'importants deficits. Tres valorisee politiquement son controle suscite de nombreuses querelles entre les diverses factions du parti au pouvoir." (110-111)

Cooperatives were the most developed in Senegal, and were part of the production of the most important product of that nation; however, cooperatives were not important outside of the peanut areas in Senegal, and were much less important in the other Sudano-Sahelian nations. For example cotton, while critical to Chad, was not grown cooperatively, nor were peanuts in Niger. Cooperatives were not even attempted for the pastoralists during the colonial period -- and rarely so even now.

In Mali, (the old French Soudan) the Societes de prevoyance (Jones translates as Natives' Provident Society) were quite significant, obliging the peasantry to contribute

stock to central storage areas in the towns. The villagers, according to Jones, regarded the society as a foreign entity and their payments to it as just another tax (1976:108). As in Senegal, the French changed the Societes into les societes mutuelles de developpement rural (SMDR, which Jones translates as Mutualist Rural Development Societies). Jones, however, regards the cooperative principle as having alien to Malian peasants. He writes "the alien principle had not been accepted by the people; they disintegrated as soon as the outside support was removed" (1976:109).

The structures left by the French, however, were either transformed, or subject to dramatic reform in Senegal, Mali, and Niger (less so in Chad, Upper Volta, and Mauritania). We now turn to the experiences of parts of the rural areas of Senegal to assess what cooperatives can and cannot do, the relationship between cooperatives and earlier forms of cooperation, the kind and form of participation in cooperatives, and the possibility of further development of cooperatives in the Sudano-Sahel.

Cooperatives, Rural Animation and Rural Conflict. Fundamemtal problems for the Sudano- Sahelian nations have been what kind of state to build, and what kind of

participation and integration should there be of the rural peoples, of the peasants and herders. How can the rural sectors of these countries be turned to greater involvement of productivity benefiting the entire nation. The history of cooperatives and the associated mass movements must be emphasized; while these did not involve many of the peoples in the Sudano-Sahel (particularly those not in commercial areas), they nonetheless are significant for understanding the potential for cooperatives and mass participation, The major movements were in Senegal, rural animation; in Niger, rural animation but different because of the lesser degree of commercialization, and lateness of forming; and in Mali, in developing the material and human productive forces of the peasantry through cooperatives based upon traditional community relations.

Senegal, Mali and Niger - Three Cooperative Experiences. Unlike East Africa, cooperatives in these three nations came to be the organizational form for increased crop production (primarily peanuts) and the modernization of the rural masses; improvement of educational and health services, improvement and greater accessibility of manufactured goods essential for agricultural production and general improvement of the standard of living. The

context in which cooperatives were developed and sustained varies from one nation to another, as well as from one region to another. In all three cases, there appears to be rather wide agreement, although for different reasons, that the cooperatives have either been not particularly successful or have been outright failures. In addition, programs which went along with the cooperatives, specifically rural animation in both Senegal and Niger, did not succeed, or were too successful, and were ended by either regional or national authorities.

A full review of the cooperative and rural animation programs in each of the three nations will not be attempted but some salient characteristics of each, for understanding some of the structural reasons for their lack of success, will be pointed out. There is tremendous variation in all Sahelian countries, and the form structure and operations of the cooperatives (where introduced) varies tremendously. The blockages for the operations of the cooperatives among Mouride Wolof in Senegal will be very different than those among the Tukoleur in the Senegal valley, and those among the Soninke in the Bakel area. At the same time, the ethnic characteristics may not be salient, as in some of the marketing cooperatives in Mali.

One major theme in all three nations concerns the degree to which entrenched local structures of power have diverted

or blocked efforts at exchanging production and the organization of work, as well as, rural political processes. Let me quote from three recent studies of rural economic change in Mali, Senegal, and Niger. (The GRPSM's are the village cooperative bodies):

Mali

> In my experience, villagers had a radically different reaction to government imposed GRPSMs (groupement rural de production et de secours mutuel) than they did to political and administrative norms, while preserving the form of the innovation to keep the central government happy. Not so with the cooperatives. Despite the belief of some politicians that the co-operatives were building on primitive rural socialism, villagers perceived the GRPSM as something novel. They conformed to government desires to varying degrees, but did not bend the cooperative structures much or fit them into existing village institutions. (Jones 290)

> The decisive inhibiting factor proved to be the colonial backwardness in the village and the persistence of ossified traditional community structures linked with it. The latter inevitably became an obstacle to the broad development of the productive forces to rapid development of agrarian production because of the laws governing their internal function and structures, especially their system of production and distribution. The traditional structures also hindered socio-economic progress. So long as they continued to function, the founding of cooperatives did not lead to a qualitative change in the social life of the village. On the contrary, the co-operatives became so much influenced by the traditional structures and leadership that their own laws of development did not come into effect, but the system of traditional relations, under the co-operative label, were stabilised and inhibited social progress (Ernst 202-203).

Senegal

> ...the Senegalese government's policies during the mid-sixties had only a marginal adverse effect, if any at all, on rural elites and private economic interests. Most of these groups were quite able to adapt to the commercial reforms launched at independence, and many continued to secure ample material and status compensation through the network of political machine ties. Although various groups did register their opposition to certain governmental policies and particular decisions (through anomic as well as associational and nonassociational interest articulation), decision-making affecting rural development policy throughout the sixties was concentrated in arenas high within the government and the state bureaucracy relatively free from outside pressure-group activity...(Schumacher xx).

> Those familiar with the workings of co-operatives elsewhere in Africa doubtless will not be startled to find that the institutionalization of the government's agricultural development programme has worked conspicuously to the advantage of privileged elements in rural society, often permitting a more authoritarian pattern of local leadership than previously (O'Brien 1975:118).

> Le systeme cooperatif s'y est bien calque sur les structures traditionnelles autoritaires, en particulier dans la zone mouride: en ouvrant les portes de l'economie capitaliste a la hierarchie maraboutique, il contribue cependant a perpetuer et a accentuer les les clivages sociaux deja existants (Gagnon 444).

Niger

> ...these programs [i.e., cooperatives, and rural animation] have led to new types of economic differentiation in an unpredicted and anti-developmental way. For the relatively wealthy and customarily powerful Hausa farmer who purchased the new agricultural innovations, these programs have resulted, not in an improvement of his productivity and his capacity to make economic investments, but rather in a reinforcement of his traditional social power through the development of new clients (Charlick 428).

Despite the diversity of ideological and analytical perspectives represented, the analysts all agree that cooperatives have not led to the goals of increasing equality and increasing participation (particularly of the poorer and less powerful). The analysts all point to the perpetuation of rural political and economic structures whose power has been intensified rather than diminished by the cooperatives; however, this did not occur without conflict locally, regionally, and nationally.

Niger and Senegal Rural Animation. Much of the conflict occured around rural animation, a movement initially developed for France by a group of Catholic socialists and then applied to Africa. It represented a humanistic orientation and direction which was to be based upon the communal ideals and structures of indigenous African societies. It was to avoid authoritarian forms of socialism and the ravages of early capitalism, and it was to induce participation by Niger's peasants; it was to transform Senegal through the economic and political mobilization of the peasantry. Both cases were to be linked with cooperatives, but not identical to them.

Rural animation needs to be seen in national, regional and local perspective. At the same time, it was a contradictory

movement. Its success (i.e. increased economic and political activity by the peasantry), would jeopardize the power holders in the rural areas, and alter national political balances since it would alter the bases of wealth and power that many national politicians held locally. The hope that activated peasants would simply follow nationally determined goals and policies proved futile because local structures of power were often not examined.

Senegal underwent a major crisis concerning the role of cooperatives and rural animation in 1962. Because of its favored status as a colony, and its relatively more developed commercial economy, Senegal also had more entrenched national class interests. Because the dominant peanut sector was based neither upon modern agriculture nor controlled by large landlords, the cooperative movement presented itself as a new mode of integration of the country. The cooperative movement threatened commercial interests and the rural religious hierarchies. The peasants involved in rural animation and the cooperatives were supported by members of the civil service and the unions who had their own interests in bypassing the traditional colonial intermediaries of marabouts and merchants. Thus, despite what appeared to be the common ideology of Senghor and Dia, they differed on the nature of cooperatives and rural

animation. As is well known, Senghor triumphed in this instance while Dia was defeated. Rural animation and the cooperatives, rather than developing and intensifying as a social movement, became the agency by which the peasants were to be integrated into the national economy, providing the surplus for both the religious and bureaucratic elite while remaining relatively powerless.

Without detailing the history and shifts in cooperatives in Senegal, (see Gagnon, Schumacher, Camboulives, and De Decker), the cooperatives were not succeeding in the terms set by the national government while simultaneously, the peasants were in increased opposition to the cooperative system. The Senegalese government shifted away from questions of democracy and participation in favor of those of increased production and profitability, pricing, credit and marketing arrangements. These changes were carried out from "above" and ultimately generated what is referred to as the "peasant malaise." Schumacher summarizes the failure of one part of Senegalese rural development in these words:

> "By the end of the sixties the programme agricole and the peanut-millet productivity program launched in 1964 had been brought to a virtual standstill in face of mounting peasant distrust, anger, and outright defiance." (1975:185).

This was due, according to Schumacher, to a variety of

reasons including the government's decision to lower the official producer's price of peanuts by fifteen percent, confusion and delays in the payment system, bad weather, and increased pressure to buy new fertilizers, fungicides and machines. Donal Cruise O'Brien reports, for the same time period, that membership in the cooperative did not imply any control of the institution from below.

> "Democratic assemblies of members (certainly those which I witnessed) were usually rather silent gatherings, held only in the presence of government officials who could ensure that popular decisions were in conformity with administrative regulations." (1975:133).

It certainly would not take the peasants long to come to the same conclusion as O'Brien (1975):

> "Co-operative marketing institutions also enable the state bureaucracy to appropriate a large part of the revenue derived from commercial agriculture, to make legal and illegal profits on a scale at least rivalling that of the private traders of the colonial period." (134).

He makes explicit the link from national conflict to the fate of cooperatives and rural animation:

> "With the fall of Mamadou Dia in 1962, the marketing co-operatives appear to revert to colonial precedent: Dia himself, just before his fall, had warned of the danger that co-operatives might become a mere 'excresence of technical administrative services'. Even this 'danger' now seems something of a technocratic utopia, and as peasant incomes decline or at best stagnate, it is increasingly clear that government bureaucracy (or in other terms the ruling elite) is more parasitic on peasant production that 'generative of agrarian progress'." (1975:137).

Schumacher, while looking at the same facts, comes to the opposite conclusion. Rather than seeing the bureaucracy's acting in its own interest as being the problem, he finds not enough bureaucracy; that the ruling elite in Senegal has not acted bureaucratically enough but rather has acted too much on the basis of clientalism. I tend to think that O'Brien is the more accurate because he gives greater weight to the peasant perspective than Schumacher.[9]

Cooperatives in Senegal haven't been nationwide, and in recent years, rural development planning has moved away from much of the earlier thinking about cooperatives. The rural development of the Senegal river basin, in particular, seems to give minimal attention to rural participation and power. Waldstein's analysis of Kassak Nord and Sud demonstrates the fact of the determination of cooperative policy and operations by SAED and SONADER and not by cooperative members.

Non-cooperative movements, like that of the Mourides, were initially quite successful in directing peasant energies. But the Mourides, like any other movement, needs to be examined in its context. The context was the defeat of the Wolof, the rise of a religious movement, and the support of the French colonialists for peanut

production in large interior areas of Senegal. The Mourides built upon some of the older institutions of Wolof society but O'Brien tends to be quite reluctant to attribute Mouride success to the work groups characteristic of the Wolof. Rather than emphasizing the continuity of Wolof work groups, he points to the nuclearisation and individualisation within what had been larger family groups. In particular, there has been a marked decline in the larger, stable working groups which O'Brien attributes to the development and spread of commercial agriculture.

Perhaps one of the most important revelations of the Mouride experience, is the degree to which the program can continue to be of significance in developing a more successful agricultural system in Senegal. The answer to that question by the French scholars, Philippe Couty, J. Roch and G. Rocheteau (economists), and Jean Copans (anthropologist), is negative. They have worked near the Mouride capital of Touba, as well as in the pioneer areas of Mouride expansion in the western Ferlo. Their studies have focused on the detailed study of time allocation of Mouride peasants including how they decide between millet and peanut production, the allocation of labor, the kind of exchange used for labor, inter and intra-village

exchanges, the economic support given to the marabouts, and the degree of dependence upon labor migration and other work apart from farming. And, of course, there is specific attention given to the Mouride ideological system and its practical implications for the Mouride productive system and the distribution and use of resources. There appears to be agreement between the French scholars and O'Brien that the Mouride system has reached its limit. Mouride organization certainly will continue but, it will become more and more involuted, consumed with internal conflicts, and unable to cope with the stagnation of agricultural production. Interestingly, despite the integration of the Mourides to the world market through peanuts, the internal relations of production are not based upon profitability. In Rocheteau's work in comparing the older Mouride areas with the pioneer ones, he suggests that:

> "L'exploitation pionniere demeure ainsi une exploitation paysanne ou le comportement du producteur est essentiellement base sur des calculs d'utilite du travail, et tres eloignee d'une exploitation capitaliste axee sur la recherche du profit et la prise en consideration du cout des facteurs du production." (1975:45).

He goes on to observe that production is essentially household based, with the household head serving both as the key organizer and the person responsible for production.

The precise description of the organization of work, and the balance between peanuts and millet production, is excellently described in the major monograph from the French research group, and supplemented by Rocheteau for the pioneer areas.

There are other questions concerning the government's allocation of land for Mouride expansion in return for continued political support. There has been much controversy over the destructiveness of the cultivation methods used on the maraboutic estates (these are different than land used and owned by Mouride peasants although the technique of agriculture may be the same). (See O'Brien 1971:220-225).

Cooperatives were formed in the Mouride areas but fell under the control of the marabouts and the marabouts vigorously opposed rural animation. They disliked the animator's enthusiasm for Thursday fields, for the benefit of the whole community, as opposed to the Wednesday work which the talibe did for their marabouts. In addition, the early animators in O'Brien's view publicly opposed the religious leaders for their corruption, usury, and other practices. It was rural animation, according to many, that led the Mourides to oppose Mamadou Dia. Again we find that national politics and overall development strategies have an impact upon village and household organization, perhaps more in Senegal than elsewhere.

Senegal has entered a new stage since the peasant malaise or, more appropriately, the continuing peasant malaise. It is turning away from reliance upon cooperatives and peanuts and relying on international funding, basing its prospect more upon the development of the Senegal river area. This will need examination in light of the relationships between rural animation, the cooperatives, the Mourides, the peanut economy, and the conflicts within the Senegalese state.

Unlike Senegal, Niger was a relatively neglected colony. There is much less national organization and unity both politically and economically. The variation from region to region and from society to society is much greater than in Senegal. The variation in the interior Niger delta, from the pastoral nomadism of the Tuareg, and the Fulbe, to the peanut-dominated economies of Tillaberi, and the Hausa of the southeastern region, et al. make it virtually impossible at this time to make generalizations about Niger as a whole. But, let us review briefly some aspects of rural animation and cooperatives among the Hausa where they have been studied, and where many of the earliest and experimental programs began. Charlick's study of four villages in the county of Matameye, where there has also been substantial anthropological work,

particularly by Guy Nicolas, provides a wealth of information about the weaknesses and strengths of the rural animation and cooperative in Niger.

Because of the specific features of Hausa society, which is among the best studied of African societies,[10] and the degree of contact with rural animation, it is hard to generalize to all of Niger from the experiences of Matameye. It appears that the effects of rural animation and cooperatives on a nation-wide scale was much less than the impact of cotton and peanut production initiated by the French. Yet they are significant in terms of understanding the potentials for rural change in Niger. In Charlick's study of rural animation, and in his effort to specify both rural modernization and to measure participation, he is very pessimistic; despite earlier claims that rural animation had been successful in Matameye.

The basis of rural animation in Niger, as in Senegal, was an effort to help mobilize peasants, what Charlick calls "induced participation". It was hoped that this induced participation would release new political forces in the village which, in turn, would power local agrarian development. The origin of rural animation in Niger was mixed. In part, it was based upon the desire to improve

the living conditions of Niger's rural population, but it equally had political origins in the attempt to undercut Sawaba's (the opposition party which was also engaging in the beginnings of armed resistance) appeal to Niger's peasants, as well as in the increasing peasant discontent based upon unchanging economic, social and political position, despite independence. Charlick also points out that the options open to the national government were exceedingly limited because of the weak control that the Diori regime had in the rural areas; and, the degree to which it had control in the countryside, based upon chiefs and merchants who were the main supporters of continuing the colonial trade economy.

But, as Charlick observes, the Diroi government was not simply interested in mobilizing peasants or in decentralizing power. It was as much, if not more, interested in "...directing change and in mobilizing village level society for national priorities. It [the national government] instituted a number of descending linkage structures to guarantee that mass organization did not become too autonomous. Both animation and cooperatives would be supervised by professional and national bureaucracies responsible to top leadership." (84) However, the reason that Matameye became the site of the first and

most intensive animation program was because of the strength of the traditional political leadership. However, the strength of that same leadership thwarted efforts to change the position and situation of the peasantry. For example, members of the local political elite accompanied rural animation teams when meeting all local contacts, a process which according to Charlick intimidated the poor peasants.

Among the Hausa, the work group is essential for the well-being of all members of Hausa society. Charlick defines the work group as "...those individuals who pursue a range of common economic activity designed to satisfy basic food, tax and social needs for their members." (156) All work group members do acknowledge the leadership of a single head (typically male in Hausa society), and, virtually all Hausa villagers participate in a work group. In the four villages studied by Charlick (although this is different for other Hausa villages), the work group coincided with the household (gida) in most cases. Linguistically, work groups are called gida and the head of the work group is also called the head of the household, maigida. Nonetheless, work groups can be more or less comprehensive than the gida, and Charlick describes the variation in work groups; some provide taxes for their

members, others do not, some eat from a single pot or grain store, others do not; some provide food from a common supply for the whole year, others do not.

Charlick investigates two things important for our purposes: 1) the relationship between work group characteristics and responses to economic innovation opportunites, and 2) whether or not there is any evidence that the process of individualization explains the existence or frequency of nuclear work group organization in Southern Matameye today. (160-161) Charlick concludes that there is little, if any, evidence to support the notion of decline in work groups, which, I might add, gives added weight to arguments for the resiliency and strength of indigenous African institutions, and indeed to their adaptability to changing conditions. However, the context in which the work groups function has changed dramatically and, despite the continued strength of work groups, Charlick writes that "Economic inequality among individual farmers exists principally because of extensive individualization of economic activity." (226) Because most work groups do not produce any surplus, surpluses must come from individual economic activity, which includes farming as well as non-farming occupation (which is indeed quite widespread).

The study of work groups, variation in the production of surplus and individual economic activity demonstrates for Charlick the extent to which great rural inequality already exists within Hausa villages. He observes that there are wide gaps "between the resources available to the few relatively well-off and the bulk of less fortunate villagers," (227) which is being increasingly verified throughout West Africa. How this differentiation will affect participation, and the kind of participation, in the development process remains at issue.

Charlick then turns to a long, and fairly complicated discussion of participation and its measurement. Again, like wealth, participation is not equal in Hausa society:

> "In the rural Hausa community, 'power' aspects of political decision making have been circumscribed by a history of hierarchial organization and as a consequence conflicts for 'power' and for great material gain may appear less apparent in this setting than in more familiar 'Western' political arenas. Nevertheless, even at the local level of Hausa society, political acts involve the struggle for status, deference, well-being, and security." (263-64)

In one dimension, little has changed in terms of participation by the poorer Hausa peasants; the customary Hausa aristocracy has remained in its privileged position and continues to extract peasant resources and labor. Because the aristocracy has adapted itself to the new patterns of

trading and administration, it has increased its power. At the same time, Charlick does find differences in participation among the three experimental villages which were part of rural animation and the one which was not but which had many similar characteristics. Charlick found that there was an intensification of participation in the experimental villages; but simultaneously, he found that political participation had "very little consequence for efficacy attitudes. The narrow measure of belief in one's capacity to secure political assistance from extra-local authorities was the only one which seemed to have any relationship to participation." (388) He also found no evidence from his questionnaires and their statistical analysis to support the view that innovative personal economic responses could be produced through political participation. He found that participation is both an independent and dependent variable. It can play an independent role in the rural economic process although, one needs to detail who participates and why, as well as the form of that participation, and as a dependent variable in terms of the explanation of who participates and why.

In summary, Charlick does not think that rural animation and cooperatives in Niger have achieved their goals. Despite the earlier, optimistic literature of some of the

participants, including Roland Colin, both the failure of Nigerian agriculture and of the cooperatives formed under rural animation, seem to bear out the conclusions of Charlick. He attributes the failure to a series of factors but says, supporting the general view:

> "Most notably, the fact that the national government never effectively reduced the power of residual elites and hence failed to radically restructure villager political participation in national politics means that this study can draw no data-based conclusions on the effects of such restructuring on the modernization of the rural economy." (424)

The perspective that cooperatives and rural animation always take place in the context of national development programs is clear once again, as well as, the corollary that one can never under-estimate the resilience and strength of local elites, and local political structures. Cooperatives, as the case of Niger shows, operate in a highly political environment even when they are not meant to. And, cooperatives in Niger have led to:

> "a growing gap between the rich and traditionally powerful and those less affluent individuals who overextended themselves economically and socially to take a change on the programs proposed to them. The 'middle strata' of rural Hausa society has all but disappeared as a consequence. Already the political impact of this growing inequality is obvious." (429)

The conclusions, while there may be some overstatement, fit with analysis of other cooperatives in West Africa. They have benefitted and have come to serve the richer in the rural areas, heightening power disparities.

There is one important commonality with other Francophone experience, in the case of Mali which appears, on the surface, to be quite different than Senegal and Niger. This is due to the use of rural cooperatives in Mali's socialist years. If one can speak of a tension between the form and structure of cooperatives in the wider society, this should theoretically be reduced in socialist societies. Yet two scholars, from markedly divergent perspectives, view the failure of cooperatives in Mali as due to the ability of local authorities to use the cooperatives to thwart governmental efforts at changing rural structures:

> "These economic results [lack of development of agrarian production] despite the comprehensive investments and measures show that it is impossible to change traditional agriculture through material support, training and education alone, without changing socio-economic relations and taking into account a number of secondary factors which we will speak of later. They underline the interrelationship between development of the productive forces and the character of the production relations." (Ernst 1976:81).

Ernst says that this happened because the traditional village leadership throughout Mali resisted the changes desired by the revolutionary single party. And, in a process not dissimilar to Niger, the members of the elite village structures became the leaders in the new rural party

structures and were thus able to frustrate many of the social and economic programs of the national government.

Thus, from a Marxist view, Ernst argues against identifying the traditional collectivism of the extended family with socialist or cooperative ideology. It will not accelerate socialist ideology, in fact the reverse:

> "as long as the extended family and the traditional community function as a socio-economic system, they continually reproduce traditionalist ideological elements in the whole movement, i.e. they will always nourish illusory conceptions of the allegedly socialist character of traditional relations and are an objective hindrance to the ideological process of cognition that is necessary for working class ideology to be able to penetrate the whole movement," (op. cit. 99)

Jones, in assessing Mali's development plans, concludes that agricultural stagnation was responsible for the plan's failure. He emphasizes the degree of variation and complexity in the village structures of Mali, and cites three dimensions of the failure; institutional failure, the effects of economic disincentives and technical mistakes. Jones' observation should be emphasized, that there was a tremendous underestimation of the:

> "...importance of institutions which differentiate and structure the economic roles of rural Malians. Many politicians thought of these differentiating institutions as 'feudal' or colonial hangovers destined to wither away rapidly in socialist independence; many were simply townsmen and had

> little understanding of rural Mali. In any case, overlooking village structures made it impossible to adapt them for Plan purposes and often guaranteed that village solidarity would work at cross-purposes to the Plan," (1976:278).

Jones views the cooperatives in Mali as being a total failure; however, his characterization tends to be one-dimensional and does not take into account the rich complexity of social and political experience embedded in the cooperative experience. We do not have many accounts at the village level, but Hopkin's work shows its texture and complexity; nor do we have material on the process of participation comparable to that for Senegal and Niger. Hopkins description of Kita, however, provides material for disucussion and debate much greater than that described for Senegal and Niger. One would expect to find, despite the analysis of Jones and Ernst, greater participation and more new structures in Mali than found in Senegal and Niger. However, this would need to be qualified, for in Senegal there have certainly been intensified efforts to alter rural life but these have been top-down. In addition, greater effort was made in Mali to break the power of merchants and traders who, throughout West Africa, bought peasant agricultural products at low prices, and charged high prices during the hungry season. However, according

to Ernst, the administrators and members of the Union Soudanaise misused their positions and benefitted privately from many of the efforts to develop fair and equitable marketing and trade relationships for the peasantry. Hopkins provides an interesting account of the Kita buying cooperative and the degree of local support for altering the buying and selling of essential commodities (see pp. 103-109).

While Mali contrasts with Niger and Senegal, in terms of the consistency of the view of the role and place of cooperatives in a national development strategy, it nonetheless has manifested the same problem of local, elite adaptation and resistance. The key problem with such resistance, has been braking the increased production and the use of the limited agricultural surplus for the accumulation of surplus for its more productive use. Thus while appearing to be different, Mali reflects the overall dilemmas of cooperatives in Francophone West Africa during the 1960's.

Conclusion. Goussault (1977) has summarized well the history of cooperatives in Africa in general, and in West Africa in particular. He emphasizes the use of cooperatives as an

instrument of governmental policies. The inclusion of peasants in the market economy, excluding their political participation, will create further conflicts in the contemporary period:

> "La creation de cooperatives est depuis un demi-siecle l'instrument privilegie des politiques agricoles dans les campagnes sous-developpees. Les administrations coloniales en ont use abondamment pour le controle de la production et de la population paysannes; les planteurs et colons eux-memes y ont trouve une forme efficace d'organisation de leurs interets professionnels; les programmes contemporains de developpement rural ou de reforme agraire en font un usage d'autant plus generalise qu'ils y voient le seul moyen de rentabiliser leur aide a la paysannerie pauvre, d'orienter le plus grand nombre de petits agriculteurs vers la production marchande et de leur offrir un cade de participation economique et sociale. Le cooperativisme demeure ainsi la panacee." (281).

The intent and purpose of cooperatives remains at issue. While governments have been concerned with terms of credit, investment, the amount of production commercialized and the implementation of national programs, these have often meant a decline in peasant participation. The socio-economic studies of West African cooperatives have shown that, rather than reducing rural inequality, cooperatives appear to be intensifying rural stratification, and that this is part of the process of increasing commercialization of peasant production. All too often cooperatives have been

used to implement national plans and goals which governments have been unable to manage otherwise, leading the governments open to charges of manipulation and deception, which in turn leads to a decline in participation in cooperatives. Cooperatives then become another institution, and a powerful one, for maintaining the hierarchical structures of both the national and local bureaucracy. The view that indigenous social and economic organization would lend itself to strong cooperatives, keeping the best of Africa and avoiding the worst of the West, has proved wrong. The dilemmas of cooperatives in Africa are the dilemmas of cooperatives everywhere; the key difference perhaps lying in the use of cooperative organization for the production of key commodities in Francophone Africa and involving continuous and direct national government intervention in the running of the cooperatives.

In conclusion, it would appear that cooperatives at this point will not be the means to avoid conflict, but rather, may become the battleground for conflicts between the rural elites and the poorer peasants for the control of, or even participation in, the cooperatives.

Indigenous Initiative

Indigenous initiative is just as characteristic of the

Sahel as is stability and tradition. Initiative needs to be examined in historical perspective and in context and structure. Many aspects of Sudano-Sahelian societies change in the name of social retention. For example, much Soninke migration from Mali, Senegal and Mauretania to France is based upon trying to keep the villages intact. The numbers and kinds of historical initiatives are great although not always apparent. According to Paul Lovejoy (1978a), for instance, the Wangara merchants were responsible for the introduction of new products into the Central Sudan such as kola nuts and for the Songhay monetary system based upon cowries and gold. Plantations, similarly, were a major economic innovation in the Sokoto caliphate (Lovejoy 1978b). Other dimensions of Sahelian life, like the spread of pastoralism itself, or shifting balances of herd composition can also be viewed as "indigenous initiative."

One of the major initiatives of West African populations, including the Sahel, has been gardening. In particular, the growing of cabbage, tomatoes, green beans, lettuce, onions, pimentos, peppers, et al. was adopted by many groups located near urban or semi-urban areas. These gardeners catered to European populations although there have also been dietary shifts among West Africans. These

gardens might involve (as in Mauretania and elsewhere) irrigation, and the digging of wells for irrigation, in order to make them successful. At the same time, the gardens initiated and developed by Hausa peasants near Maradi in Niger, for example, were not run simply on profit. Despite the sale of produce, there was no separation of the cash crop gardens from overall household economy, nor were they expanded or diminished simply on the basis of profitability. As Raynaut (1969) points out, in trying to understand why many Hausa gardeners operated their gardens at a loss, and did not have separate budgets for them, we must always include social pressures, social aspirations, and ideology in order to understand any apparent incoherence in the operation of the economic system. The Hausa gardeners cannot be dismissed as non-initiatory nor non-economically oriented; rather, their investments, labor, and marketing are in the context of their social system which includes kinship, friendship, hierarchy, religion, et al. As cooperatives were influenced by the Hausa, so apparently are economic family enterprises, like gardens.

Markets and market exchanges are part of the indigenous evolution of West Africa. Olivier de Sardan (1969) reports that, among the Wogo before colonization, the elders perceived the dissolving role that market exchange had upon

traditional social relations. Markets were indigenous to the region, but the market of Meanna, founded by the French around 1920, became the most important. Linked to the markets is an ethnic specialization but there must be very dramatic changes involving economic shifts to rice, tobacco, peanuts, onions, green beans, as well as the older patterns of milk, butter, mats, baobab leaves, etc.

Indigenous wisdom and initiative needs to be protected; for example, the maintenance of the diversity of plant and animal species current in the Sahel in order to save plants that are used by indigenous healers for curing purposes. Studies continue concerning the use of herbs and leaves for their nutritional values and the effects if they were dropped from rural diets. The question of local and specific initiatives is not controversial. What remains the major issue, from an anthropological/sociological perspective, is what initiatives are selected for and why? What initiatives are seen for or against development; which in turn, raises the whole concern over development for whom?

The key questions for initiatives are not simply economic, or those of more "rational" production or distribution, but are also social and political. For example, during the drought, several West African governments continued

taxation in the most devastated areas. There is evidence of serious rural discontent in Niger and Mali (Ormières 1975 and Derriennic 1977). The efforts by Malian peasants to avoid paying taxes was certainly a significant effort to reduce their economic burden and to make their government more responsive to their pressing needs. We have already discussed the longer term agricultural crisis in Senegal; many peasants have withdrawn fields from peanuts in order to increase food crop production, reflecting resistance to authority as well as an initiative against a strong hierarchy.

Initiative, then, always takes place in a given social, political, economic, and physical environment. That environment is now in the process of being transformed by the internal developments of the Sahelian nations, by the drought and its aftermath, and by the international strategies and linkages to the Sahel. This context can directly affect what appears to be a small project in a relatively isolated region of Senegal (Derman 1977). As the scale of the programs and projects increases, the political dimension will take on increasing significance. Projects such as the damming of the Senegal river, will become part of political debate and disagreement.

Selection and reward for initiative need to be examined. Are only those initiatives which increase participation in a market to be rewarded? What about initiatives to withdraw or pull back from dependence on the world market? What about initiatives to cut-back peanut, cotton or other production when revenues fall; an economically rational decision for a cooperative or an individual, but perhaps disastrous for a national government dependent upon exports? Should initiatives to resist the commercialization of food crops be supported or opposed? What about the initiatives of those people, in various parts of the Sahel, who oppose the variety of projects and programs designed to help them? The answers to many of these questions can be only in the social and political domain; in the relationship between those who hold power and those who don't, locally and nationally; in the process of education and the nature of participation. Initiative can also be constrained, clocked, or turned to resistance; confining initiative, by efforts to increase market involvement or efforts to support projects and programs may miss, divert, or block genuine initiatives. The question is then, which initiatives are selected for support, and which ones are to be opposed? And who decides support and opposition?

This is linked to the earlier analysis of change and cooperatives, where increasing class stratification and inequality in the rural areas is reflected in rural power structures.

The questions raised need to be answered before decisions can be made about which indigenous initiatives are to be recognized and enhanced. The linkage of projects to local elites, or to emergent national bureaucratic elites, who are viewed with increasing suspicion and hostility by the rural poor, probably means increased conflict and a diminishment of initiative, except in narrow terms.

Two further points might be made with regard to the question of initiative. First, one needs to look at the approach of those attempting to change Sahelian society, and second, who are being selected to do that from both within and without the Sahel. The approach of change agents, all too often, is that of this writer:

> "...the peasant cultures [of the Sahel] had evolved over long periods of time, had assimilated new movements such as the Islamic religion and, more recently, the colonial administration; the status quo provided security, if not wealth and equity for most members of the society. The cultural and religious mores of their ancestors were accepted without question; for example, they firmly believed that their future life depended in part upon their cooperation and

> subservience to the Muslim marabouts. They had no desire for economic growth and change, no concept of working to earn profit, to save and reinvest, and to use time as a resource in development. Their traditional leaders met their modest needs, and their ambitions did not go further. Like most human beings, they were willing to try new ways, as long as these did not threaten the structures which had been providing them with security," (Moulton 1977:190).

This issue impacts on the question of initiative which can only be, in Moulton's view, adoption of profit motivation. Initiative needs to be seen in a much broader context. Lecomte (1978) argues that rural initiative is stifled by the political structures of projects which prevent independent action on the part of peasants and herders once they are enmeshed in a project. Their experimentation and initiative is truncated by the way management or projects are conducted, and by the views held by the managers. There is, in Lecomte's view, no substitute for respecting peasant responses and initiatives. If indeed, development is for them, they must be involved at all levels, from the planning to the implementation process. Lecomte links the issue of initiative with that of participation. To have peasant initiatives, modifications and participation, Lecomte asks:

> "Comment alors imaginer qu'ils vont prendre en charge et acquérir maitrise de leur développement, s'ils ne participent pas à

> la mise au point et a une sorte de découverte locale des techniques et des méthodes qui deviendront les leurs et qu'ils maitriseront de ce fait?"

Initiative and participation are further linked to the structure of authority in any given project. Lecomte fears that, all too often, management of projects slides toward the dictatorial. Without project structures that encourage participation and experimentation management will be dictatorial:

> "La correction raisonnée des erreurs du project est-elle possible dans la pratique de ce mode de gestion? On peut en douter, car la source des rectifications est essentiellement la volonté paysanne exprimée par coups de force et non la volonté commune exercée par négociation, après reflexion, entre des groupements de paysans et la societe." (1978:105)

Before turning to the other question which this perspective raises, whether or not conflict between national and local structures is inherent, we might examine briefly whether or not there are marked differences between the West African views of peasants and herders and the views of some Western administrators and scholars. There needs to be a more detailed regional and national assessment of who represents the national governments in the Sahel and what their approaches and attitudes are toward the peasants and herders. Lecomte cites a statement, by an agronomist (unnamed) working in Francophone West Africa, which pinpoints many of the difficulties of the relationships among

the new technicians, project employees and peasants:

> "J'ai negocié de nombreux projets avec les aides: l'argent va à l'encadrement, c'est la plus grave erreur. Les agents sont des obstacles au développement. Le paysan se dit: 'Puisque l'Etat paie bien cet encadreur qui fait si peu pour moi, pourquoi ne paie-t-il pas mon développement aussi.' Et quand l'encadreur rentre par une porte, la paysan sort par l'autre. Plus tu augmentes le nombre d'encadreurs plus le pays recule. L'un d'eux a vidé l'encadreur de son champ en criant. 'Ton papa t'a nourri, il ne venait pas au champ avec des bottes, lui; sors-toi de la!' Si nous pouvions faire comprendre que le paysan n'est pas idiot! Qu'il peut faire tout cela lui-même en s'organisant, en regardant, en visitant des essais bien faits...L'encadrement va contre le développement, cela le paysan le voit. Il voit qu'ils ne sont pas à son service. Certains disent: 'Ils sont payés pour nous détruire..." (1978:107)

Unless the relationship between managers and employees and participants in the projects can be altered, peasant initiative will indeed be stifled.

Analysis

Development cannot be without conflict. No society or nation consists of people with entirely common interests, goals and values. These conflicts are rural-urban, ethnic, regional, (distribution of services, regional disparities in wealth, resources, etc.) as well as national/local. One can certainly envision situations in which there would be little or no antagonism between national and local goals

but, despite statements that there is no such conflict in the Sahel, this is not the case. While national policy and goals often assume a commonality and conflict-free development, this needs to be examined critically. The fundamental question underlying national and local conflict, concerns the roles of the peasantry and herders in plans for development (i.e. both agricultural and industrial). The questions of the importance of the agrarian sector, what direction should development take, how much can the Sahelian nations industrialize, and what priority to which sectors of the economy, remain under live and heated discussion. Many writers have pointed to an urban bias in the structures of power and the flow of resources in the Sahelian nations, despite the fact that the vast majority of the population lives in the rural areas. It appears that current efforts are designed to take away the little control that remains to peasants and herders, in order to intensify this exploitation.

There is agreement among virtually all sectors of Sahelian nations concerning the urgent need for more effective development, a development which generates not only the ending of the conditions of famine, but also generates a process of economic growth leading to real

and rapid change in the standard of living of Sahelian rural populations. How this is to be done is greatly contested; the balancing of environmental factors with narrow economic ones; with appropriate technology versus advanced technology; the relationship of Sahelian nations to the industrial world and patterns of trade; food self-sufficiency versus increasing dependence upon food imports. We have already discussed increasing social divisions in the rural areas. How will these different divisions see and respond to national development plans? To which sectors of the peasantry will different development programs appeal?

One of the most interesting aspects of rural animation, both in Niger and in Senegal, was an effort to set up a different type of relationship between animators and peasants. Can the national governments of the Sahel supply field technicians and rural extension workers who will be sympathetic, understanding and responsive to the peasantry? Will they live as peasants, finding their rewards in the success of small-scale changes or will they aim to live as their wealthy, urban counterparts? As Markovitz (1977), Hapgood (1965) and Dumont (1968) have all pointed out, despite the plans and the advice of foreign experts and technicians, the money goes where the power is and the power is not in the control of the peasantry so the money

usually doesn't go to benefit them. Markovitz asks, "Does this group [the small group that holds power, military or otherwise] really want to innovate? Do they really desire 'progress' if a rise in the standard of living of those in rural areas would threaten their own way of life, their own positions in society?" (1977:334) The new bureaucracies will not be apolitical and will not be able to assess the interests of the peasants in an objective, disinterested manner. That is not the nature of politics. As Markovitz states:

> "The ideology of the technocrats, their mode of operation, and their class interests - in conjunction with the political alliances of other elements of African's organization bourgeoisie - threaten the interests of the dispossessed. What a tragedy if encadrement ends only in the firmer entrenchment of the bureaucrats in their offices. Foremost among the political obstacles to real economic development, therefore, may well be the 'developers' themselves. Who indeed will not only 'guard the guardians' but also develop the developers?" (1977:340-41)

If the national power structures do not include the peasantries, and if analyses like that of Markovitz are accurate, we can expect greater conflict between national and local structures. Waldstein in his analysis of the Kasak scheme in Senegal poses similar questions:

> "...do structures and terms of production fixed by agencies of the national government strengthen the peasant producer's position as he moves farther into the world economy

> or do they restrict his maneuverability to the point where he becomes more vulnerable than in a subsistence economy to crisis? More concretely, is participation in hydro-agricultural production a rational economic decision for a peasant producer? Will he be materially better off for having chosen to participate? According to some acceptable definition of development do these hydro-agricultural works qualify as development projects? If not, how might the waters of the Sahel be used that they genuinely fuel development?" (1978:1)

Waldstein poses the other side of the development question from the perspective of the peasant; what appears to be rational development for the planner may cause real loss to the peasant, economically, socially and politically. Waldstein's analysis of the Kasak zone observes: "The results show that the natural and institutional constraints [on meeting objectives of planners]... have conspired to push the peasant producer's net income in the zone of Kasak in the direction of, if not below, the threshold of his subsistence needs." (1978:28)

Some see genuine possibilities for development within the current framework while others, like Wallerstein, are exceedingly pessimistic. In discussing the integration of Africa into the World Economy from 1975 onwards, he writes:

> "This same period will be one of acute suffering for truly peripheral areas (of which the Sahel is one, and in contrast to semi-peripheral ones) whose non-essential exports will find a very weak world market and whose internal food production may collapse further. They will bear the brunt

> of death from famine and major transfers of remaining populations from rural areas to bidonvilles. The corresponding political regimes will almost certainly be that of corrupt and repressive pretorians. The principal consequence for the social structure will be the disintegration of the third zone, the so-called subsistence sector, clearing the land areas of men and largely sounding the death knell for the concept of a proletarian labor force. The 'reserve army of the unemployed' will thus become visible but also will have to be kept alive by some process of social redistribution of income." (1976:49).

This grim vision is however, contested by increasing numbers of West Africans, of both left and right perspectives, those who base their optimism upon increasing outside funding to CILLS, and the increasing activism of peasants and workers. (e.g. Sine 1975) What does appear inevitable from either perspective is an increasing politicization of the assessment of development plans.

Most governments and international agencies present the Sahelian development programs as having no political implications or dimensions. The well-being of the population, recovery from the drought, environmental rebuilding, and increased food production remain the most oft-stated goals. Yet, how local populations are to be mobilized and why and how they are actually going to support the development plans is, typically, left unstated. An identity of interest is assumed between international development agencies,

national governments and local populations, or alternatively, local populations are viewed as obstacles to development plans. In both instances, they are characterized as "traditional", living in outmoded societal forms, and having to be made to work, act and think as "moderns". Even when plans include efforts for popular or local participation, they do not usually study local or national inequalities, or assess who will actually benefit economically. The Sahel is presented as being outside of ordinary development concerns.

However, this is no longer the case and is certainly not understood in this way any longer by Sahelians. For example Adrien Adams quotes a peasant from Bakel as saying:

> "La S.A.E.D. [Societe d'Amenagement et d'Exploitation des Terres du Delta] travaille pour la S.A.E.D., pas pour le paysan. Tous les paysans du fleuve Senegal, on sait ca. Parce qu'on a vu ce qui se passe a Matam. Alors on veut travailler independants, paysans, travailler un peu et beneficier nous-memes. Si les paysans ne peuvent pas avoir de benefice eux-memes, ils n'ont qu'a continuer leurs petits champs-la. Tout le monde, a la maison, on n'a jamais manque, quand on a notre petit daba. Maintenant, on veut beneficier en plus. On travaille pour nous. Si on a un peu, on s'en sert nous-memes. Comme cette annee: on a eu dix tonnes de riz. Les dix tonnes de riz on en a vendu a cinquante francs le kilo. Toute la ville en a achete, ils sont contents. Si on avait envoye ces dix tonnes de riz a decortiquer la-bas, a la S.A.E.D. on n'aurait rien.

> Alors, pour la question S.A.E.D., on sait. S.A.E.D. c'est le gouvernment, et nous, nous sommes les paysans. On est là. S.A.E.D. est là; mais les paysans doivent exister aussi. Ils doivent vivre. Comme le monde entier. Notre décision de développement, c'est sur ce point-là. Si ce point-là est perdu, le développement est négatif. Voilà." (Diabe Sow, April 1976 in Adams:175)

In the Bakel example, which Adams is discussing, national and international forces combined to prevent local initiative on the one hand, while on the other, determining how and what crops were to be grown, the techniques to be used, the crops to be grown, and the organizational forms to be employed. The working conclusion cannot be escaped; peasants cannot be permitted to develop or control their own organization. Despite the rhetoric of S.A.E.D. employees, that there is no conflict of interest between the employees and the peasants, there in fact is. S.A.E.D.'s objective is to increase rice production in the Bakel region (and elsewhere) in order to meet food deficits in the cities, and to diminish rice importation. S.A.E.D.'s principles of operations are fixed, and cannot be altered by peasant wishes and organization. It represents the conflict between national needs and priorities on the one hand and local needs and priorities on the other. However, that conflict hasn't been acknowledged or made explicit; in fact, it's been denied by S.A.E.D. The conflict is also

an international one. Since the funding of many projects comes from international sources, and because of the overall stagnation of the Senegalese economy and indebtedness of the government, international forces have claims upon Senegal. Simultaneously, the Senegalese state has a fundamental interest in preventing the tension between it and rural peasants or producers from being politicized, or intensified. The stability of Senegal hinges upon the prevention of class conflict. Development programs in Bakel and in the rest of the Sahel act, either intentionally or not, to prevent that politicization.

While discussion of the political dimensions of development leads not only to difficult questions, but to potential problems with the Sudano-Sahelian nations, there can be no full assessment of development without such consideration. In my estimation, politicization is necessary. If production and productivity are to increase, there must be the release of peasant energies, and the orchestration of peasant energies in more organized forms. Otherwise those peasant energies will continue to be absorbed in patron-client relations, or in individual or family solutions. The process of increased vulnerability of peasants and herders to market forces, demands of the state, and metropolitan powers will increase.

There appears to be a critical dilemma in the Sahelian programs; namely, that popular participation and mobilization will be necessary for their success. But, in order to get a release of peasant energy, peasants will have to be included in the processes of decision-making, and the programs will have to be in greater accord with their interests. This direction will go against the goals and objectives of many of the projects; thus, when peasant initiative and organization develops in directions opposed to "development", it has to be stopped. (For an example see Derman 1977).

All too often, those who oppose the development programs are viewed as conservatives, against progress, traditional on the one hand, or conspiratorially-minded, utopian radicals on the other. Development in the Sahel has been presented as an apolitical process and one which appears to be that way because of the weak development of classes in the Sahel. But we will not be able to understand the action of, for example, the S.A.E.D. unless we view it, not as the representation of modern forces for development within Senegal, but rather as the expression of particular class interests, both within and without Senegal. Thus, the question of popular participation cannot be separated from the question of class. The question remains about development for whom, and if it is for

the "poorest" (as the World Bank and other aid agencies claim), why can't the poorest be included at all levels of decision making?

I cited Lecomte's contention that one needs to alter the basic decision making structure of projects in order to include those most affected. Franco (1978) argues that one needs to alter the basis of many projects. Both Lecomte and Franco suggest (as have many others) that too many projects do not include a complete assessment of both the needs of a community, and the consequences of a project. Franco writes:

> "L'introduction des cultures commerciales a donné aux paysans la possibilité d'augmenter leur niveau de vie à court terme. A long terme, pourtant, l'intégration dans le marché a enlevé aux FST [traditional social formations] le contrôle de leur processus socio-économique. Les mécanismes qui determinent le niveau de vie des producteurs se situent maintenant au niveau national et même mondial. Les méthodes de production sont imposées et ne laissent que peu de marge d'adaptation aux conditions locales. Le premier objectif des projets de développement doit être de rendre aux communautés de base le controle de leurs conditions de vie. Ceci implique la nécessité d'une approche globale permettant de couvrir plusieurs aspects de la vie sociale et de l'environnement en même temps et mettant l'accent sur la mise en place de structures nouvelles de déliberation et décision." (147).

The participation in development by those most affected, very rarely provokes any disagreement among academics, although often does with technocrats and bureaucrats. Thus,

despite verbal and rhetorical acknowledgement of participation, it doesn't emerge. There must be structural constraints, stemming from whose interests these projects and plans represent, to prevent peasant or local participation and mobilization. The years of drought and the increasing likelihood of recurrent famine to be overcome successfully, must engage rural energies which have yet to be tapped in the Sahel. I am afraid that the example of Bakel stands for the ultimate neglect of the interests of the peasants, to the benefit of the interests of the state.

At the same time, despite all the discussion about the effects of drought upon the pastoralists, Jeremy Swift writes "At no stage have serious efforts been made to rethink development of Sahelian pastoral economies in their entirety, with the principal aim of improving the standard of living of the pastoralists themselves" (1977:474-75). Often, the situation of pastoralists and herders cannot be understood without a full political discussion placing them in relation to who holds power over them, both locally and nationally.

The reliance upon international agencies and developed organizations for development in the Sahel, reflects the weakness of the West African nations in being unable to undertake that process themselves, even within a capitalist framework. The development of the productive forces in the

Sahel is being done primarily under the design of non-West Africans with a view of preventing or inhibiting rural instability from increasing. In sum, the dilemma of Sahelian programs and reconstruction efforts, of how to use peasant and pastoral energies without permitting politicization and organization, is not resolvable. To genuinely be able to transform the Sahel back into a productive environment, and to increase the Sahelian contribution to economic development, there must be real mass participation and enthusiasm. However, for such a possibility to emerge, it appears that the governmental structure now attempting to control rural populations will have to be changed. This appears unlikely without a great increase in rural political conflict and resultant instability, and without the development of opposition political movements in the Sahelian countries.

FOOTNOTES

1. The modernization literature is now enormous. It includes both political, economic and psychological dimensions. At the same time there are a variety of approaches within the general framework. It is too large a litterature to provide adequate references here. Dependency, like modernization, has a large literature and similarly reflects different approaches. Both dependency and modernization have as many critics as proponents. Perhaps the foremost dependency theorist at this time is the Egyptian economist Samir Amin. One of the major strengths of dependency theorists, despite their weakness, is their emphasis that development will not and probably cannot take place in the same way in most of the Third World as it did in Europe and the United States and Japan.

2. The best work on the early history of the Wolof remains Boubakar Barry's Le Royaume du Waalo: le Senegal Avant la Conquete. Paris: Maspero, 1972.

3. The Tukoleur are very strategically located in Senegal along the Senegal River. The most complete study remains La Moyenne Vallee du Senegal (Etude Socio-economique) by J. L. Boutillier, P. Cantrelle, J. Causse, C. Laurent, and Th. N'Doye, published in 1962 by the Presses Universitaires de France. Abdoulaye Diop has written an excellent study of Tukoleur migration called Societe Toucouleur et Migration, Dakar: I.F.A.N., 1965. The best anthropological general study is that of Yaya Wane, Les Toucouleur du Fouta Tooro, Dakar: I.F.A.N., 1969. In addition, there has been a great increase in historical writing on the Fouta-Toro including David Robinson's Chiefs and Clerics: Abdul Bokar Kan and Futa-Toro, 1951-1891, Oxford University Press, 1975 and B.O. Oloruntimehin's The Segu Tukolor Empire, New York: Humanities Press, 1972.

For contemporary Senegal, the Senegal River area is once again looked on as being of central significance. For a critique of current plans see Adrian Adams "The Senegal River Valley: What Kind of Change?" in Review of African Political Economy Number 10, September-December 1977 (pp. 33-59). For a critique of the development plans, see Mark Franco "Le Programme de Developpement du Bassin du Fleuve Senegal," in S. Amin, M. Franco, S. Sow, La Planification du Sous-Developpement: Critique de l'Analyze de Projects, Paris: Anthropos-I.D.E.P., 1975.

4. The Tuareg have been relatively well-studied by several anthropologists from a variety of theoretical perspectives. These include: E. Bernus, Les Illabakan. Une Tribu Touareque Sahelienne et Son Aire de Nomadisation. Atlas des Structures Agraires. ORSTOM, Paris: Mouton; "Les Composantes Geographiques et Sociales des Types d'Elevage en Milieu Touareg," in Monod's edited volume on Pastoralism in Tropical Africa; "Les Eleveurs Face a la Secheresse en Afrique Sahelienne: Exemples Nigeriens" in Drought in Africa II edited by David Dalby; "Possibilites et Limites de la Politique d'Hydraulique Pastorale dans le Sahel Nigerien." Cahiers ORSTOM, Ser. Sci. Hum. 1974, Volume 11 pp. 119-26, Jeremy Swift.

"Disaster and a Sahelian Nomad Economy," in Drought in Africa I edited by D. Dalby et al; "Pastoral Nomadism as a Form of Land-Use; the Twareg of the Adrar n Iforas," in Monod, Pastoralism in Tropical Africa; J. Nicolaisen, Ecology and Culture of the Pastoral Tuareg. The National Museum of Copenhagen, 1963.

In addition, there is the thesis of Pierre Bonte entitled Production et Echanges Chez les Touaregs Kel Gress du Niger which I wasn't able to obtain along with the new book of Jeremy Keenan, not yet published. Part of Pierre Bonte's work has been published as a monograph in Etudes Nigeriennes, Number 23 (1968) entitled L'elevage et la Commerce du Betail dans l'Ader Doutchi-Majya. In addition A. Bourgeot has an excellent article entitled "Analyse de Rapports de Production Chez les Pasteurs et les Agriculteurs de l'Ahaggar" also in the Monod Pastoralism volume.

5. The Maures are much less well studied than other groups like the Tuareg and Fulbe. Much of the best recent work has been done by the French human geographer Charles Toupet. His work includes "Le Nomade, Conservateur de la Nature? L'exemple de la Mauritanie Centrale" in the Monod Pastoralism volume; "La Grande Secheresse en Mauritanie" in Drought in Africa II, edited by D. Dalby et al; and, the major work of Toupet La Sedentarisation des Nomades en Mauritanie Centrale Sahelienne, Dakar: I.F.A.N., 1975. A recent effort to summarize what is known is L'etrier, la Houe et le Livre: 'Societes Traditionneles' au Sahara et au Sahel Occidental by Francis de Chassey, Paris: Editions Anthropos, 1977. The book concerns principally the Maures but also the Tukoleur.

One of the few studies of recent changes is that of Pierre Bonte entitled "Conditions et Effets de l'Implantation d'Industries Minieres en Milieu Pastoral: l'Exemple de la Mauritanie" also in the Monod Pastoralism volume.

6. There is a very rich literature now on peasant rebellions, revolutions, as well as stability. Some of it is based upon the work of the Russian economist Chayanov, The Theory of Peasant Economy (Homewood Illinois: Irwin, 1962, originally published in Russian in 1926). More recent literature rests upon the pathbreaking work of Eric Wolf including studies like that of Joel Migdal, Peasants, Politics and Revolution: Pressures Toward Political and Social Change in the Third World, Princeton: Princeton University Press, 1974. There is not the space here to present a full bibliography but only to suggest that Sahelian and West African peasantries need to be put into the context of what we already know about peasant political and social responses. This is not to suggest ignoring what we know about peasant economics which is another area similarly filled with disagreement both at the theoretical and practical levels as I have tried to indicate.

7. There has been a recent revival of interest in the question of African slavery, its historical development as well as its residue. For a general assessment there is the forthcoming paper by Martin Klein and Paul Lovejoy "Slavery in West Africa," in H. Gemery and J. S. Hogendorn, The Uncommon Market: The Economics of the Trans-Atlantic Slave Trade (New York). For specific studies including societies of the Sudano-Sahelian zone see the edited volume by Claude Meillassoux L'esclavage en Afrique Precoloniale (Paris, 1975) and Suzanne Miers and Igor Kopytoff, editors, Slavery in Africa: Historical and Anthropological Perspectives, Madison: University of Wisconsin Press, 1977. I know of no studies dealing with the current significance of former slaves in the current division of labour although there are many hints in specific studies.

8. "Tribe" while commonly used outside of anthropology retains no clear meaning or definition. In fact it is subject to contradictory and conflicting use. Virtually all definitions of "tribe" would be so broad as to include almost all humans (as in common language, or common cultural heritage) or so narrow as to rule out any contemporary society as being organized on a tribal basis (for example, lack of central government, or politically autonomous). Liberian forest societies, though, during precolonial times were organized in a less hierarchical and more egalitarian fashion than the states of the Sudano-Sahel. For a recent discussion of all the difficult intendant upon the concept of tribe see Morton Fried The Notion of Tribe, Menlo Park: Cummings Publishing Company, 1975.

9. O'Brien is more pessimistic about Senegal's future than Schumacher. He posits that Senegal can't escape its underdevelopment because of the vicissitudes of climate and geography. Senegal, in O'Brien's view, has found greater than expected stability in a system of patronage, clientism and peanuts. Schumacher tends to identify more human limits on Senegal's underdevelopment. But because in his research Schumacher relied so heavily on French and government sources this predisposed him toward bureaucratic solutions. His view of politics is as a disruption from norms of good bureaucracy. He does not treat the diverse and differentiated Senegalese peasantry which lessens the impact of his work.

10. The most detailed economic studies of Hausa rural economies has been done by Polly Hill in a series of books: Rural Hausa: A Village and a Setting (Cambridge University Press 1972); Population, Prosperity and Poverty: Rural Kano 1900 and 1970 (Cambridge University Press 1977) and Studies in Rural Capitalism in West Africa (Cambridge University Press 1970). In addition there is the earlier political and historical work by the anthropologist M. G. Smith including The Economy of Hausa Communities of Zaria. Colonial Research Series No. 16, HMSO, London, 1955. The references for Nigeria are far too many to attempt to attempt to list here.

For Niger the work on the Hausa is primarily based upon three anthropologists, Guy Nicolas, Claude Raynaut and Ralph Faulkingham. Their work is listed in the bibliography. However it is important to point out that there is great variation both between Nigeria and Niger as well as regionally within each nation for Hausa communities. The mere fact of speaking Hausa is not enough to know what the economic characteristics of any given community will be.

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