Plants, Animals, & People

Agropastoral Systems Research

edited by Constance M. McCorkle

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This book is dedicated to the editor's parents,
Burford and Martha McCorkle,
in thanks for their lifelong support and encouragement.

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Foreword

The responsibility for writing the Foreword generally falls to a presumably neutral outsider who is expected to provide an aura of external legitimization. This Foreword departs from that model significantly, however. The author is in many ways the consummate "insider," having served as principal investigator for the Sociology Project of the Small Ruminant Collaborative Research Support Program (SR-CRSP) since its inception in 1978. This may lay my comments open to charges of being self-serving and biased; but it also affords them a unique vantage point.

In 1977 when my colleagues and I first encountered the things we've come to know as CRSPs, and specifically the Small Ruminant CRSP, my initial reaction was bewilderment. "What on earth," I remember thinking, "would sociologists be able to contribute to a program like that?" Interestingly, in 1990 this continues to be a common question among many of my social science colleagues (not to mention biological scientists) whenever the subject of the SR-CRSP is raised.

In a sense this book constitutes the best possible answer to that question. The volume offers a deliberate sampling of the products of over ten years' effort. It reflects the quality output, the wide range of research topics, and the global span of the SR-CRSP Sociology Project—the only one to have worked in all five of the program's host countries. This broad scope has allowed the project to tackle not only issues specific to a given location but also subjects that span multiple sites. Both perspectives are represented in the chapters that follow.

Over the past decade, two overarching themes have emerged in the work of the SR-CRSP Sociology Project. First, the project has given considerable attention to piecing together the puzzle of how livestock (especially small ruminants) interface with crops and people in a farming systems context. The chapters by Perevolotsky, Primov, and Mendes and Narjisse are good examples of how this theme was developed in Peru, Brazil, and Morocco, respectively. A prominent subtheme has been the social organization of SR production. This focus is exemplified in the chapters by McCorkle and Fernández, who look at how families and communities organize themselves to meet the unique labor demands of livestock production in conjunction with crop production.

Indeed, "agropastoralism"—the complex blending of crops and livestock in a farming system—is the unifying thread running throughout all these analyses.

Early on we determined that agropastoral production systems are far more common than "pure pastoralism." Moreover, relatively little research had been done to understand the features of such systems. Thus, we choose to emphasize them in our work.

The second major focus of the Sociology Project has been the examination of how technology "fits" into the social environment. Assessment of technology impacts on different biosocial groups such as women, evaluation of the effects of longterm trends on the current environment (see, e.g., the chapters by Mbabu and Conelly), and models for disseminating new technology are key topics here. In programs like the SR-CRSP, sociologists have a special responsibility to help ensure that people's lives will not be worsened by the technology being developed. In that sense, off-station/on-farm research is a critical part of the program's overall effort. In addition, social scientists must also function as constructive team members; as such, they must be prepared to make positive recommendations concerning how to "package" technology so as to maximize its benefit to the target group. Chapters 7 through 11 in this volume present good examples of how we have tackled these tasks.

The road traveled to reach the point where a volume like this seemed both desirable and feasible has not always been easy. Elsewhere, we have reflected on the dilemmas that confront sociologists and anthropologists who participate in programs like the SR-CRSP (*The Social Sciences in International Agricultural Research: Lessons from the CRSPs*, C. M. McCorkle, ed., 1989). Suffice it to say that reconciling programmatic "needs" with disciplinary "respectability" has not always been easy. The reader will no doubt detect different styles of compromise in the research topics chosen and in the approaches taken to presenting research results. We believe, however, that the end result will be considered "good" sociology/anthropology by our disciplinary colleagues while also being of use to our colleagues in the biological sciences. I think all these groups will find this book interesting reading.

Michael F. Nolan
University of Missouri–Columbia

Acknowledgments

This volume represents a sampling of some of the extensive social scientific findings on agropastoral production systems to have emerged from the Small Ruminant Collaborative Research Support Program (SR-CRSP) during its first decade of existence. While the focus here is on the intermeshing socioeconomic, cultural, and ecological underpinnings and dynamics of such systems, it is no exaggeration to say that hundreds of SR-CRSP students, researchers, and collaborating scientists from perhaps a score of different disciplines and dozens of training and research institutions throughout Brazil, Indonesia, Kenya, Morocco, Peru, and the United States have contributed directly or indirectly to the body of thought presented in this book. Although their contributions are too numerous to list here, many are noted in the acknowledgments that accompany each chapter. The breadth and diversity of these contributions give testimony to the integrated, cross-disciplinary, and truly "inter-national" approach to agricultural research and development that is the signal feature and overarching strength of the CRSP model.

Equally and perhaps more important, countless hundreds of stockraising farmers worldwide volunteered untold thousands of hours robbed from the business of surviving in their difficult physical and human ecologies in order to participate in the on-farm trials and intensive data collection efforts on which this volume is based. As partners in the R&D enterprise, these women and men responded with great insight and intelligence, almost superhuman patience, and a sometimes-much-needed sense of humor to what must have seemed interminable and occasionally silly questions. The authors of this volume owe their greatest debt of gratitude to these individuals, their real "partners in research."

Of course, these pages would never have reached print without the unstinting support of Dr. Michael F. Nolan, principal investigator for the SR-CRSP Sociology Project, professor of rural sociology, and associate dean for International Agriculture Programs at the University of Missouri–Columbia (MU). During the four years that the volume was in the making, he shepherded it through many a budgetary and coordination quandary, always lending advice and encouragement just when they were needed most.

Many thanks are also due Shirlene Hecht and Dr. Sharon Wood-Turley, who handled the computer graphics. As sociology project intern and information

officer, DeAnna Adkins took in hand most of the ongoing copyreading and proofing. MU's Ann Statler prepared all the artwork. Last, but certainly not least, Judy Gieselman served as overall production manager, coordinating with the publisher and giving the book her usual meticulous attention.

Constance M. McCorkle
University of Missouri–Columbia

Acronyms

DC	Developing Country
FAO	Food and Agriculture Organization
g	Grams
hh	Household
kg	Kilograms
km	Kilometers
Ksh	Kenya shillings
l	Liters
£	Pounds sterling
m	Meters
ml	Milliliters
mm	Millimeters
MOA	Ministry of Agriculture
MU	University of Missouri–Columbia
Rp	Rupiahs
SR-CRSP	Small Ruminant Collaborative Research Support Program
SWDGP	Samia Women's Dairy Goat Project
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
(US)AID	(United States) Agency for International Development
USDA	United States Department of Agriculture
WID	Women in Development
WIIAD	Winrock International Institute for Agricultural Development

PART ONE

Introduction

1

AGROPASTORAL SYSTEMS RESEARCH IN THE SR-CRSP SOCIOLOGY PROJECT[1]

Constance M. McCorkle

Agropastoralism can be broadly defined as any system of mixed crop and livestock production in which herd animals derive a portion of their diet—whether directly (by grazing) or indirectly (from cut-and-carry forages)—from plant crops, crop residues or byproducts, or fallowing fields. The agronomic and, to a lesser extent, the animal-science aspects of such production systems have received a respectable amount of conventional research attention, albeit often independent of one another (see below). But the same cannot be said for the complex social, cultural, and political-economic dynamics of agropastoralism. The goal of the present volume is thus to elucidate the "people" part of such plant/animal production systems. To do so, the book draws upon more than a decade of research on agropastoralism worldwide conducted by the Sociology Project of the Small Ruminant Collaborative Research Support Program (SR-CRSP).

The SR-CRSP is the oldest of eight such CRSPs (pronounced "crisps"). They constitute innovative, interdisciplinary agricultural[2] research and development (R&D) programs established under the U.S. International Development and Food Assistance Act and its Title XII amendment, the Famine Prevention and Freedom from Hunger Act. The CRSP mandate is, through cooperative training and research, to strengthen the ability of both U.S. and host country institutions to apply agricultural science to solving world food and nutrition problems. CRSPs focus on enhancing the production, distribution, storage, marketing, and consumption of key food commodities among smallholders and the poor in developing nations. This is done through design of appropriate crop and livestock technologies, management practices, and alternative processing, marketing, and related strategies.

The first foodcrop selected for CRSP research was domesticated small ruminants, i.e., sheep, goats, and the American camelids (alpaca and llama). One or more of these species is raised in all developing countries, where they play a vital role in both national and local-level diets and economies. Moreover, these species are primarily managed by smallholders. Hence the establishment in 1978 of the SR-CRSP, in cooperation with five host countries (Brazil, Indonesia, Kenya, Morocco, and Peru) that together are home to a majority of the small-ruminant husbandry systems found among limited-resource producers globally.

The program itself is composed of nine closely linked disciplinary projects: animal management/production systems, range management, nutrition/forages, reproduction, breeding/genetics, animal health, systems analysis, economics, and sociology/anthropology. Of the eight CRSPs in existence at this time, the SR-CRSP is the only one to formally incorporate sociological and anthropological inquiry in a unit of equal standing with the biological/technical disciplines.[3] This component—the Sociology Project—has played a major role in advancing both scientists' and international developers' understanding of the dynamics of agropastoral systems.

PLANTS, ANIMALS, AND PEOPLE

Very few "pure" cultivators or "pure" pastoralists are to be found in the developing world. The overwhelming majority of rural peoples "impurely" raise both plants and animals. Yet within such mixed production systems, the agricultural sciences—social and biological alike—have traditionally treated cultivation and stockraising in virtual isolation and/or ignorance of one another. Given the heavily crop-oriented history of agricultural R&D, this has generally meant that relatively little scientific heed is paid the pastoral half of mixed farming. Many factors have likely conspired to bring about such blinkered or skewed views of agropastoralism.

Perhaps the major culprit is simple scientific reductionism—the common and often necessary heuristic of delimiting the reach of one's research so as to facilitate investigations and arrive at more elegant conclusions. Reductionism occurs both intradisciplinarily and disciplinarily. As an example of the former, animal scientists tend to concentrate on a single species or commodity (e.g., cattle, milk) even though it may be managed and marketed alongside a variety of other animals and animal products (e.g., sheep, goats, alpaca; manure, meat, and fiber) within the same farming system. Similarly, agronomists often specialize in a single crop.

To take a more pernicious example of intradisciplinary reductionism, social analysts of primary production systems have been prone to set up false dichotomies between pastoral herders and "peasant" cultivators, ignoring cropping among the former and stockraising among the latter. A classic case is the

ethnographically famous Nuer "cattle culture" of the Sudan. The Nuer have conventionally been portrayed as "pure" pastoralists. Yet without their "gardening" of staple cereals and pulses, they could not survive the year (Evans-Pritchard 1969:75 ff.). Conversely, social scientists have traditionally and even vehemently defined the native peoples of the Andes as almost solely dependent upon cropping, despite the fact that virtually all also keep animals (McCorkle 1990). Moreover, in these sierran farming systems, "Of all labor inputs, none is more lucrative" than stockraising (Brush 1977:116). Indeed, animals provide one of the first lines of defense in smallholders' fight for subsistence (see below).

Taken together, agronomy, animal science, and sociology/anthropology—with their avowedly distinct interest in plants, animals, and people—exemplify disciplinary reductionism. Ultimately, of course, these broad differences in scientific focus are what define a discipline. Such boundaries are drawn because they are necessary for the practical conduct of research and the derivation of nomothetic principles. However, it is easy to forget that they are in fact artificial constructs, created for a delimited scientific purpose and a highly abstract level of analysis. At the farm level, disciplinary boundaries blur back into a complex, commingled reality wherein plants and animals are intimately intertwined parts of a systemic whole that forms the foundation of an agropastoral people's very existence. Reductionism at this level is indefensible—both because this is where applied research and development action take place, and because it is precisely the panoply of tradeoffs and payoffs among different subsystems of production (cropping, herding, or others such as off-farm employment) that ensures the survival of smallholder farmer-stockraisers. Piecemeal study of these production subsystems and application of the therefore fragmented findings can have disastrous development consequences. For this reason, an interdisciplinary approach is imperative when it comes to devising and introducing successful interventions in an agropastoral system.

Beyond reductionism, still other factors have worked to disengage cropping and herding in past research in mixed farming systems and to distract attention from the pastoral part of such systems. Some of these factors involve insidious ethnocentrisms. With few exceptions (e.g., hogs + corn), contemporary commercial agriculture in the Western world, and particularly in North America, is characterized by specialized operations that raise crops *or* livestock but not both. Thus, when agricultural scientists from the First World look at mixed production systems in the Third World, their reductionistic tendencies are exacerbated by own-culture assumptions that only one subsector of production is the predominant or economically significant one.

Usually the livestock subsector is assumed to be subordinate. In part, this is because to Western eyes, the flocks and herds of limited-resource producers in developing countries may appear so small as to be negligible—often little more than half a dozen scrawny, sickly-looking creatures. No matter that—as many of the authors in this volume emphasize—these animals constitute a multipur-

pose commodity whose value to household economies and rural societies is not captured in mere head counts. Western stockraising operations normally emphasize only one animal product—meat, milk, or fiber. But for Third World smallholders, even a single animal is typically valued for a galaxy of goods and services. Depending upon the species and the culture, for herd animals these may include any combination of not only meat, milk and milk products, or fiber, but also: manure for fertilizer, fuel, or construction; blood, leather, hides, and minor products like bone, horn, sinew. gut, and hair; traction, transport, and clearing services; investment and fiduciary roles for which no other capital-storage alternative is available locally; of course, medicinal, ritual, and social functions, e.g., in natural or supernatural curing, in sacrifices, feasts, and rites of passage like marriage, and in recreational activities involving racing, riding, or fighting animals; and finally, herd animals' ability to move to and exploit numerous ecological niches. (See Table 1.1.)

Western-trained scientists are often unaware of these many diverse roles and values of even tiny herds. Whether because livestock in the Western world do not fill such functions or whether because some of the values placed on animals' varying goods and services in the developing world are not always readily quantifiable in market-oriented, money-economy terms, researchers can easily overlook the importance of livestock in smallholder mixed farming. They are even more likely to overlook small ruminants, thanks to still further ethnocentrisms. For one, much of the Western world holds a strong "cattle bias" that can render smallstock of all sorts nearly invisible. Again, this is especially true for North America, where cattle are the culturally preferred source of milk and red meat. In contrast, in other cultures, these same goods may be supplied by different species—e.g., goats or by a combination of large and small ruminants.

Another and often related ethnocentrism that has obscured the importance—indeed, sometimes even the existence—of small ruminants is the longstanding patriarchal prejudice of Western society. This often-unconscious bias can cause researchers to see only the agricultural work of adult males as important.[4] In consequence, in societies where women and children take charge of smallstock while men attend to cattle raising and cropping, only the latter activities may receive serious or thorough-going scientific attention. Along with other factors, this prejudice seems to have been at work, for example, in the mistaken generalization that rural Andeans are essentially cultivators. In the Andes, women and children typically see to herding while men primarily devote themselves to cropping.[5]

In an effort to avoid many of the dangerous reductionisms and ethnocentrisms enumerated above, recent farming systems research (FSR) paradigms of on-farm R&D have taken a more comprehensive approach to the study of mixed production systems that ". . . looks at the interactions [both social and biological] taking place within the whole farm setting" (Shaner et al. 1981:14). In actual practice, however, most FSR to date has vouchsafed only a rhetorical nod to the

subsector of production not under direct scrutiny in a mixed system. Given the agricultural sciences' historical emphasis on cropping research, plus added difficulties in on-farm experimentation with animals (Amir and Knipscheer 1989, McCorkle ed. 1990), this has meant that even FSR has been disappointing in terms of advancing our understanding of agropastoralism.[6]

In sum, although scientists have painstakingly described and analyzed the agrarian activities of many of the world's rural peoples, for a variety of reasons they have been slow to investigate the pastoral aspects—biological and especially sociological—of these same societies. They have been even slower to integrate results from such investigations into theoretical models of agricultural change and development and then to translate them into practical development action.

The present volume offers a corrective to this imbalance. It is no accident that the authors of this book collectively represent multiple disciplines (sociology, rural sociology, anthropology, ecology, range management, animal husbandry), several nationalities (Israeli, Kenyan, Moroccan, Peruvian, and U.S.), and both sexes. SR-CRSP research has been distinguished by its aggressively collaborative nature. The program aspires not only to the non-reductionist goal of interdisciplinary integration but also to even further forms of collaboration: among scientists of different cultures, so as to better forestall ethnocentric research assumptions; between scientists and producers—with the latter viewed as co-researchers and co-developers who will also be the end-users of new technologies and management practices—so as to better grapple with the gap between abstract and applied levels of R&D; and finally, between and among scientists and producers of different gender, age, and other statuses, so as to better ensure the equitable distribution of R&D outcomes among all these potential beneficiary groups.

APPROACHES TO AGROPASTORAL SYSTEMS RESEARCH

Just giving added weight and attention to the pastoral aspects of mixed farming systems is not enough to rectify the oversights and imbalances described above. Not only must research on agropastoralism be two-pronged, tackling plant and animal domesticates alike. It must also target the dynamic interface where the two subsectors meet within the larger production system—what I will term the agropastoral nexus. Insofar as past research has attended to this nexus, it has typically addressed only the positive dynamics between cropping and stockraising, highlighting numerous now-familiar complementarities. These take many forms: ecological, technological, economic, and socio-organizational. Drawing upon findings from Sociology Project research, Table 1.1 summarizes the most directly positive interactions at this agropastoral nexus. (For useful overviews, see, e.g., Bayer and Waters-Bayer 1989, McDowell 1980, and Vincze 1980.) However, Table 1.1. also lists a number of strains, tradeoffs, and tensions in people's simultaneous pursuit of plant and animal agriculture. As the table

TABLE 1.1 COMPLEMENTARITIES AND CONFLICTS IN AGROPASTORALISM[a]

■ HERDING AND CROPPING CAN COMPLEMENT EACH OTHER VIA:

Keeping fields under constant production by rotating their use between crops and livestock [2, 5, 7]

Diversifying the subsistence base, thereby in turn reducing overall farming risk [2, 3, 4, 5, 7]

Varying and enriching the farm family's diet [3, 10]

Decreasing cash outlays for both plant and animal foodstuffs [10]

Increasing income sources [virtually all chapters]

Relatedly, each subsector's generating capital that can be used to support the normal operation of the other [2]

Employing production-unit and community labor more fully and/or productively [2, 5-7, 10]

Allocating labor in a more energetically parsimonious [5] and/or more efficiently specialized [6] manner

■ HERDING CAN COMPLEMENT CROPPING VIA:

Providing draught power and transport for crops and crop inputs [5, 6, 8]

Furnishing fertilizer in the form of manure and urine, and generally promoting nutrient pooling (e.g. through composting with manure, livestock bedding, etc.) [2, 5, 8, 10, 11]

Exploiting nonarable lands, other biomes, or seasonal shifts that could not otherwise be made productive for human use [2, 4, 5]

Grazing animals' manuring and re-seeding/trampling, which promotes vegetative cover to forestall erosion on fallow fields [5]

Grazing animals on fallow land to help clear it for renewed cultivation [2, 5]

Cultivating forages on fallow lands so as to combat wind and water erosion

In the case of cultivated nitrogen-fixing forages, improving soil fertility [7]

In years of crop failure, recovering some of the value of cropping inputs by grazing the failed fields

Through stock sales, generating cash for the costs of re-initiating cultivation after a crop failure [2, 4, 6]

Also, providing substitute animal foodstuffs for humans during crop failures [2, 3, 4, 6]

Storing surplus capital earned from cropping in a highly fungible form that also yields "interest" in the form of herd growth both through reproduction and gains in body weight [2, 3, 8]

Providing seasonal credit for crop inputs, whether through sales of livestock and their products or through animals' serving as collateral [2, 6]

TABLE 1.1 COMPLEMENTARITIES AND CONFLICTS IN AGROPASTORALISM[a] *continued*

■ **CROPPING CAN COMPLEMENT HERDING VIA:**

Furnishing stored plant foods for humans during periods of pastoral problems [2, 4, 6]

Improving and stabilizing livestock diets with crop byproducts, stubble and high-quality supplemental feeds [2-8, 10]

Beyond just supplementation, providing stored feedstuffs that may spell the difference between herd survival or extinction during periods of forage scarcity [4]

Using fallow fields to raise cultivated forages so as to assure adequate livestock nutrition during seasonal shortfalls in other feed sources [7]

Turning any last residual effects of crop fertilizers to good use by, e.g.:
- grazing animals on the weed growth of fallowing fields
- planting fallow lands with forages [7]

Through sales of crops, generating cash to meet emergency needs for livestock inputs (e.g. veterinary supplies to combat an epidemic)

■ **HERDING AND CROPPING CAN CONFLICT VIA:**

Competing for access to scarce arable land for production of feed crops for animals as versus food crops for humans [3, 7, 10]

Competing for limited nutrients — e. g., using crop residues and stubbles for animal feed instead of plowing them back into the earth to "feed" fields

Competing for scarce capital and thereby prejudicing the sustainability or productivity of one subsector or the other, e.g. by:
- endangering the critical reproductive composition of herds because of pressures to "cash in" livestock so as to support cropping [2]
- conversely, blocking planned capital outlays for cropping due to extra costs (e.g. for health care, herding services, emergency feed) or risks (e.g. losses from rustling, disease) entailed by herding [2]

Competing for limited amounts or skill-levels of labor generally, and especially during "crunches" in the agropastoral production cycle when both crops and livestock require special attention [2, 5, 8-11]

Relatedly, spatially dispersing labor (for herding) when it most needs to congregate (for cropping), or vice versa [2, 5]

Essentially doubling the demands on the production unit for specialized technical knowledge [5, 6, 9]

Triggering disputes among socioeconomic units over, e.g.:
- animals' destruction of crops
- individual and group rights to manure, animals, or land and water for cropping versus grazing
- timely access to use of shared draught animals for field preparation [5, 7, 9, 11]

[a]Extracted and summarized from the chapters (bracketed numbers) in this volume plus other research documents and publications of the SR-CRSP Sociology Project.

indicates, many of these conflicts are simply the inverse of the complementarities inherent in agropastoralism.

To illustrate, cultivation and stockraising may complement each other by more fully employing household labor and more efficiently allocating tasks, skills, and technological knowledge across diverse biosocial groups (e.g., juvenile, adolescent, adult, and eider females and males). But during certain seasons or circumstances, conflicts may arise between the two subsectors over shortages of household labor of the appropriate age and skill-level needed to attend to equally pressing crop and livestock chores (see especially Chapters 2, 5, and 6). To take another example, animals provide "feed" for fields in the form of manure; in like vein, crops generate residues and byproducts that can be used to feed livestock. But these plant materials can also be plowed back into the earth to nourish future crops. Here again, the two subsectors are in direct competition over a limited resource.

Until little more than a decade ago, these sorts of potentially disintegrative strains between cropping and herding were largely ignored in the literature on agricultural R&D—even though, as Perevolotsky (Chapter 2) points out, the ancient story of Cain and Abel forewarns of stresses between the two pursuits. At least for the social sciences, inattention to the negative dynamics at the agropastoral nexus can be attributed in part to inadequate theoretical approaches.

One such approach is neofunctionalism, which in its application to the study of agropastoralism is too ready to assume an overly simple, closed system in homeostatic equilibrium. This assumption of a "harmonious whole" makes analysis insensitive to the kinds of intrasystemic tensions described above and outlined in Table 1.1. Likewise for the application of narrow ecological models, which focus primarily on the relationships between the production system and biotic and climatic variables. While valuable, such models fail to capture both fine- and coarse-grained, intra- and extra-systemic abiotic variables that may drive people's production decisioning and their valuation of tradeoffs between subsectors (Orlove 1980, Perevolotsky this volume).

For example, neither a functionalist approach nor a narrow ecological model can explain why some (but not other) Andean agropastoralists consciously and heavily overgraze the fallowing fields nearest their village, thus leading to massive colonization by toxic vegetation that ultimately prejudices stockraising; at the same time, this practice promotes soil erosion and compacting that ultimately prejudice cropping in these same fields. Only an integrated understanding of negative as well as positive interactions between subsectors and of abiotic as well as biotic constraints can explain such seemingly "irrational" behavior. For an accurate analysis, stresses and variables such as the following must be considered: the type and amount of labor that the production unit can mobilize for cultivation versus stockraising; herd size and the sex, age, and species composition of household herds; availability of capital and/or labor for fencing or for establishing grazing outposts vis-à-vis competing capital require-

ments for cropping; land tenure regimes pertaining to rangelands versus fields; extra-community political constraints to expanded access to land; and still more. (For detail, consult Jamtgaard 1984 and McCorkle 1987.)

Eschewing both neofunctionalism and narrow "ecologism," the SR-CRSP Sociology Project has instead taken an eclectic and truly holistic systems approach. This stance is still strongly ecologically grounded. Indeed, reminiscent of a Thomas Hardy novel, nearly every chapter in this book incorporates the biotic communities involved in the agropastoral systems under examination as active, energetic forces in intimate interaction with their associated human communities. This does not mean, however, that the SR-CRSP espouses narrow-ecological or technoenvironmental determinism. Rather, it focuses on the intermeshing of the biophysical environment with the social, cultural, economic, and political environments, and on the back-and-forth, push-and-pull among all these components at the agropastoral nexus.

For example, a recurrent subject in this volume is producers' shrewd intra- and inter-annual use of all available ecological niches (no matter how poor they may seem) vis-à-vis plant and animal growth cycles, climatic fluxes, and the contrasting and often shifting roles assigned to different crops, livestock breeds, and both plant and animal products in people's risk- and resource-management strategies and in their cash/kind or on-/off-farm tradeoffs. These roles, strategies, tradeoffs, and consequently producers' differential allocation of natural resources to cropping as versus herding are in turn conditioned by multiplex abiotic or suprabiotic considerations. These include, e.g., changes in composition of the domestic unit, family emergencies, rapidly fluctuating markets, often-closely-related vagaries in the political weather, plus other, sometimes culture-specific factors such as ritual obligations or food preferences.

Obviously, the SR-CRPS's holistic perspective has entailed studying a wide range of interrelated topics and issues (see McCorkle et al. 1989 for an overview). The resulting plethora of subject matters nevertheless finds some unity in what has come to be the overarching framework for social research within the program: the imperative of situating *any* agricultural R&D effort within its fullest possible ecological context—human as well as biophysical.

THE HUMAN ECOLOGY OF AGROPASTORALISM

The human ecology of agropastoralism can be defined as embracing all the many levels and layers of sociocultural, economic, and political structures relating to individual, intra- and inter-household, community, regional, national, and even international control over and utilization of plant and animal domesticates and the resources necessary to raise them.

At the most basic such structural level—the individual—a human ecological focus dictates systematic attention to even more elemental parameters such as gender, age, and kinship. Thus, a regular topic of SR-CRSP social research has

been the relative roles of different biosocial groups in the production, transformation, consumption, and distribution of agropastoral products. In an effort to counterbalance past research emphases on plant agriculture and males, however, the SR-CRSP has paid particular attention to the long-ignored pastoral roles of women and children in mixed farming systems.

These roles are many and culturally varied. For example, in the *despoblados* of northern coastal Peru, women and their daughters do the milking, and they make cheeses both for home consumption and sale (Chapter 2). Whether in the despoblados or the high Andes (Chapters 5 and 6), women and especially children (both daughters and sons) do most of the household's daily herding; in the Andes the children of kin and non-kin may also be enlisted. But in Kenya milking, herding, and various other pastoral chores are largely or at least traditionally the province of household men and boys (9, 10). In parts of Kenya and in Indonesia (7), women do much of the cleaning of livestock quarters (typically a male job in the Andes, however) and most of the watering and feeding of animals kept in full or partial confinement. In both Indonesia and Peru, women play significant roles in veterinary care, too. And in the Andes but not in Kenya, women also have a major say in culling and marketing animals and their products, and in deciding on the disposition of the cash thus earned. As Chapters 6, 9, 10, and 11 in particular demonstrate, it is critical to delineate such biosocially constituted roles and, further, to recognize how they may be evolving—whether at the household or societal level; whether in "real" or culturally ideal/institutionalized terms; and whether as a result of endogenous or exogenous pressures or opportunities. Only with this knowledge is it possible to design workable, equitable interventions in any agropastoral regime.

Broadening this focus on the human ecology of agropastoralism, Fernández (Chapter 6) outlines how, within a neighborhood of Andean communities, management of the multifarious tasks of smallholder agropastoralism and of the natural resource base to support it is differentially vested in a nested hierarchy of socio-economic-political units. In ascending order, these units span: individual household members, again parsed by gender, age, and their differential decision-making powers, technical knowledge, and task assignments in cultivation versus herding; households—the basic unit of production; established inter-household workgroups of males, females, or both, who collaborate in specified crop and livestock production activities; and local governing bodies, who exercise authority over community-wide issues of natural resource use. As Fernández aptly argues, a clear comprehension of the varying roles and responsibilities assigned to the interlocking units within this complex human ecology is essential if researchers and developers want to get the right information to and from the groups who have the real authority and skills to institute change in agro- or pastoral technologies and practices.

Focusing in on the lower rungs of this same hierarchy in another sierran community, McCorkle (Chapter 5) presents a detailed microlevel analysis of

how Andean agropastoralists strategically allocate their scarce human resources within and among kith, kin, fictive kin, and "outsider" households so as to daily range as many as four species of herd animals across three widely dispersed agrolife zones, all the while also seeing to the never-ending work of multicropping. This process entails producers' juggling differential nutritional requirements and caloric expenditures across diverse livestock species and varying ages and sexes of *both* humans and animals; astutely deploying individual herders according to their knowledge of a given livestock species' ethology, disease susceptibility, etc.; and carefully weighing the social and economic costs and benefits of opting for extra- versus intra-household labor. The result is a wide variety of smallscale socio-organizational tactics for mobilizing pastoral labor. McCorkle echoes Fernández in underscoring the need for an in-depth understanding of how and why producers presently deploy their human resources as they do vis-à-vis the simultaneous demands of herding and cropping. Researchers and developers can thus draw upon elements of the existing human ecology for use as valuable building blocks, models, and metaphors to stimulate agricultural change—in this case, to institute larger-scale and more efficient forms of labor organization and range management that redound to the benefit of both subsectors of production.

For yet another Andean community, Guillet (Chapter 7) extends the analysis of the human ecology of plant and animal production to shifts across time as well as across both biophysical and social space. He details how, through an incremental re-organization of water and land tenure, this community was able not only to improve its stockraising but also to enhance the fertility of its fields cum pastures. Via the auto-introduction of alfalfa (a leguminous forage), the productivity and sustainability of the agropastoral system as a whole was increased. In this instance, a rural community in effect designed and implemented its own development project! This case offers further, compelling evidence of the importance of understanding the human ecology of development. With such social intelligence, agricultural interventions are made much easier. In their efforts to improve agropastoral production systems, developers can build on and from producers' existing or evolving socioeconomic and political structures instead of struggling to impose alien ones.

Incorporating the human ecology into the analysis of agropastoral systems does not stop at the borders of the local community, however. It means going beyond, to look at broader geosocial contexts in which rural producers are ultimately embedded. For example, Guillet mentions longstanding mechanisms of cooperation and exchange between the community he studied and adjacent "pure" pastoralists of the high punas. These mechanisms allow each group to directly or indirectly exploit the agrolife zones that the other inhabits. Likewise, Mendes and Narjisse (Chapter 4) do not confine their examination of range-animal ecology and agropastoralism among the Berbers of Morocco's Atlas Mountains to a single community, valley, or montane biome. Instead, these

authors extend their analytic reach to include important socioeconomic interdependencies all along the vertical landscape that traverses 3600 m of altitude across several hundred kilometers and links the production system of highland agropastoralists to the peoples and the plains at the foot of the mountains.

In a combined diachronic and synchronic analysis that explicitly targets such interlocking cultural-ecological levels, Perevolotsky (Chapter 2) highlights mutually beneficial socio-organizational and ideological relationships between goatherders (who also raise crops) of Peru's arid despoblados and small farmers (who also keep goats) of the coastal river valleys. These linkages result in a regional level of integration across vastly different ecozones that facilitates both groups' timely access to alternative productive resources during periods of acute climatic stress. When climatic conditions are favorable, however, herders find themselves in direct competition over rangeland resources with a different group—commercial cattle ranchers. Further complicating these complementary and conflicting relationships among multiple human and natural environments are the depredations of urban wood merchants, the establishment of agricultural cooperatives, the actions of government officials and policies, and the fickleness of international commodity markets. Among other things, Perevolotsky demonstrates how a narrow ecological analysis focused primarily on climatic and biotic variables would mask other, abiotic stresses within despoblado agropastoralism, as well as higher-order sociostructural and sociopolitical constraints—all of which would need to be addressed in any effort to improve crop and livestock production in the region.

For western Kenya, Mbabu (Chapter 11) likewise offers a thoughtful exegesis of the interactions across both time (colonial, contemporary) and space (local, regional, national, international) among diverse and ever-shifting social, economic, political, and racial groupings in their struggle for control over the land and labor necessary for crop and livestock production. Using both largescale survey techniques and smallscale case-study methods, in what is perhaps this volume's most ambitious analytic effort, Mbabu ultimately links farm-level choices and strategies, actions and reactions, and especially gender impacts to the global political economy. Along with the chapters by Bilinsky and Gaylord (8), Noble (9), and Conelly (10), Mbabu's work also takes into account one of the paramount variables in the interaction between biotic and abiotic communities—vast and even frightening flows and pressures in human population.

Several chapters examine yet another segment of the human ecology of agropastoralism: national agricultural research and extension systems. The structure, functioning, and institutional culture and ideology of these systems can (and indeed should) directly impact upon producers' and nations' social and agroeconomic well-being. But the impacts will be positive ones only insofar as these organizations and their functionaries possess a clear and fully contextualized understanding of the agropastoral peoples and systems they seek to assist.

Unfortunately, as Primov (Chapter 3) observes of Brazil's National Center for Goat Research, even with the best of intentions, researchers of smallholder agropastoralism readily fall prey to the reductionistic tendencies and ethnocentrisms noted earlier. In particular, Primov warns that the research/extension establishment must ward against its proclivity to focus on a single commodity (in this case, goats) divorced from the other plant and animal domesticates in producers' overall strategy of risk and resource management. Both Primov and Conelly (Chapter 10) also caution against assuming that all of a smallholder's productive efforts are market-oriented. Such myopic views at best result in producers' rejection of new but inappropriate technological or managerial offerings. At worst, because of the delicate nexus between cropping and herding, they lead to interventions that merely rob Peter (the agro) to pay Paul (the pastoral) or vice versa—in the process defeating people's purpose in raising the commodity in the first place, or even imperiling basic human nutrition.

Bilinsky and Gaylord (Chapter 8) note that at least some of these misconceptions and the inappropriate and unworkable technological "fixes" they engender flow from an institutional culture that distances scientists from the very people they are supposed to serve. National agricultural research systems are usually heavily staffed by urbanites who may have little or no firsthand experience with farming or farmers. Nor do these scientists' R&D institutions—which have traditionally emphasized on-station rather than on-farm research—encourage them to acquire such experience or reward them for working directly with rural producers. Moreover, linguistic, cultural, and class differences may make such contact difficult. Worse still, researchers may consciously or unconsciously subscribe to societal values that stigmatize classes who engage in hard manual labor such as that entailed in smallholder agropastoralism. Bilinsky and Gaylord describe how, via the SR-CRSP/BPT Outreach Pilot Project, scientists of Indonesia's Research Institute for Animal Production (RIAP) began to grapple with some of these kinds of human-ecological problems, thereby improving their ability to design and deliver technologies more appropriate to RIAP clienteles.

Noble (Chapter 9) takes such analyses of the institutional culture of agricultural R&D even further. She details how both conscious and unconscious ethnocentrisms at all levels—from individuals, households, and communities, to projects, national political parties, and international donor organizations—can pervert program goals. Her specific concern is an ethnocentrism shared by Kenyans and many of their foreign donors: a pervasive patriarchalism that couches women's roles in agriculture and women's rights to the fruits of their own participation in agricultural development in terms of benefits to families. As Noble convincingly documents, this idiom of "benefits to families" in fact often translates into benefits for men and extra work for women (see also Chapters 10 and 11). Drawing upon SR-CRSP experiences in cooperating with a interinstitutional dairy-goat project in Kenya, Noble demonstrates how once again, even with the best of intentions, an imperfect understanding of

the human ecology of agricultural R&D leads to distorted and inequitable "development."

Of course, the final cross-cutting issue raised in this volume is the driving one behind all SR-CRSP endeavors. To wit, how can findings from the program's holistic research approach be put to practical development use so as to enhance human well-being? Or put another way, in agricultural R&D, how does the R relate to the D? It is testimony to the achievements of the SR-CRSP Sociology Project, and to the value of social research in agricultural R&D generally, that virtually every chapter in this book concludes with two, equally useful and "useable" analyses of the data presented: concrete, hands-on recommendations for developers and planners seeking workable interventions in the specific agropastoral system studied; and larger lessons learned that can, and should, be immediately applied in agricultural R&D on agropastoral systems generally.

CONCLUSION

In a sense, agropastoralism is at once the problem and the solution for many rural peoples of the developing world. To borrow a concept from the architectonics of R. Buckminster Fuller, the challenge that every agropastoralist faces is to construct a farming system with dynamic "tensegrity"—a system that integrates the tensions among its elements in such a way that each element operates with the maximum economy and efficiency possible at any given time. The corresponding challenge for agricultural scientists is, working together and with farmer-stockraisers, to understand how best to attain and then sustain such systems in specific biophysical and human ecologies. To do so successfully, tensegrity must also be achieved among many different disciplines.

Thus, collaborating closely with other SR-CRSP components and with the ultimate experts in agricultural systems analysis and operation—women and men producers themselves—the Sociology Project has sought to paint a more complete picture of the myriad interactions among plants, animals, and people in agropastoral production systems. This picture takes both synchronic and diachronic perspectives; incorporates global and regional as well as local "color" in its palette; brushes in the sometimes clashing tones in the interrelationships among agroecozones, species, and human groups; and frames all this holistically.

Indeed, the breadth and diversity of the contributions to this volume give testimony to the holistic, eclectic, and highly collaborative approach that is necessary to begin to understand, much less improve upon, the world's most common yet perhaps most complicated farming systems. To the extent that the findings reported here suggest broader principles of smallholder agropastoralism worldwide, the authors' hope is that a variety of groups concerned with international agricultural R&D will be able to profit from the SR-CRSP's first decade of research. These potential beneficiaries include: agricultural scientists;

development professionals, planners, and policymakers; and above all, the "real people" who raise both plants and animals.

NOTES

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2. Throughout this introduction, "agriculture" is used in its fullest sense, to refer to either or both plant and animal production. However, on occasion the terms "plant agriculture" and "animal agriculture" may be employed for specificity.

3. The projects are currently directed by nine land-grant universities and one private research foundation. For details of program organization and operations, consult Blond n.d., Oxley 1989, and Raun 1989. McCorkle et al. 1989 or Nolan et al. 1989 provide more information on the history, structure, research results, and guiding principles of the SR-CRSP Sociology Project. For CRSPs in general, see McCorkle ed. 1989.

4. In yet another reductionistic scientific tradition that has unfortunately been accompanied by a great deal of colonially and/or officially imposed ethnocentrism, these are the often elusive "male heads of household" so much sought after in development circles as interviewees and proximate units of analysis.

5. As an overview of the full ethnographic literature reveals, however, this is something of an oversimplification both across and within Andean communities.

6. Hopefully this is changing, stimulated by the work of programs like the CRSPs, of institutions like WIIAD (formerly, Winrock International Livestock Research and Training Center) and ILCA, and bolstered by volumes like this one or that of Amir and Knipscheer (1989).

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PART TWO

Agropastoral Systems: Form and Functioning

2

INTEGRATION VERSUS CONFLICT: CROPS AND GOATS IN PIURA, PERU[1]

Avi Perevolotsky

And Abel was a keeper of sheep
but Cain was a tiller of the
ground (Genesis 4:2).

The Department of Piura lies along the northwest coast of Peru just south of the border with Ecuador. The region is known both for its extensive cotton estates, which produce for international markets, and for its large herds of goats. The Piuran lowlands span two very distinct ecological zones: the fertile, cultivated river valleys, and the vast scrubland plains or *despoblados* 'uninhabited lands' between the rivers. Cropping and stockraising together form the principal economic activity in Piura. Agriculture is the main source of subsistence for river-valley peasants, while goat husbandry is the primary support of peasants living in the scrublands. Cultivation is not confined solely to the river valleys, however. Many peasants—herders as well as farmers—attempt to grow short-season crops (mostly maize) in rainfed fields on the despoblados. Conversely, many farmers, smallholders, and members of agricultural cooperatives keep goats as a secondary economic activity.

This chapter examines the relationships between Piuran crop and livestock systems on two levels: the region, as an integrated arena of production; and the household, as the main unit of production. The emphasis is on integration between plant and animal agriculture as an adaptation to the highly variable and unpredictable environment of Piura. But attention is also given to economic, political, and technological/managerial conflicts inherent in relations between the two systems.

MODELS OF PASTORAL AND AGROPASTORAL SYSTEMS

Ever since the days of Cain and Abel, cropping and stockraising have been considered conflicting subsistence activities. Herders roam with their animals in search of pasture and water while farmers are usually sedentary. When the two come into contact, conflict and hostility often ensue. Herders' animals may be accused of damaging crops, while farmers are accused of attempting to grab rangelands for cultivation. Raiding, taxation, or the collection of protection fees have characterized herder-farmer relationships in different parts of the world at different times in history (Burnham 1979, Spooner 1973). Given such antagonism, it is little wonder that even scientific analyses have focused on "pure" pastoralism or agriculture alone, rather than on interrelations between these two ancient modes of human subsistence (Dyson-Hudson and Dyson-Hudson 1980, Orlove 1977).

However, as more detailed field records on the actual economic activities of traditional and less traditional herders or farmers are gathered, two key principles emerge. First, most peoples who specialize in or emphasize one of these types of production also depend on commodities from the other for their daily existence. This is certainly true of most pastoralists, whose main foodstuffs are grains produced in agricultural regions (Dyson-Hudson 1972, Monod 1975). Second, it seems that most herders attempt to practice cultivation as part of a multi-resource economy (Salzman 1971), even if they do so only on a temporary or seasonal basis and even if they display a strong ideological dislike for cropping (Spooner 1973). Dyson-Hudson and Dyson-Hudson (1980) rightly highlight the distinction between degree of dependence on pastoral (or agricultural) products for one's daily livelihood, versus commitment to herding (or cropping) as one's principal economic activity or lifestyle.

Goldschmidt (1979) suggests a general model of pastoral social systems in which three kinds of relationships between animal husbandry and agriculture are possible: independence, integration across independent ethnic units, and secondary farming. The ethnographic literature documents only a few examples of independent pastoralism. Addressing regional integration between cropping and herding, Swidler (1980) proposes a further, tripartite classification: a dichotomized economy where integration is rather weak; a mixed economy where integration is strong, whether at the level of the community or the household; and an intersecting economy where resources from one type of production are later used in the other. However, the Dyson-Hudsons' recent (1980) review of nomadic pastoralism stresses the enormous variability in almost every facet of pastoralists' life, including their dependence on agricultural systems.

Although the literature on interrelations between agriculture and pastoralism is still limited (Hjort 1981), three lines of analysis can be discerned. The first is *ecological*, in which the two activities are seen as complementing each other

through more efficient energy extraction, thus enhancing human survival in harsh environments. A much-cited example is montane agropastoralism which, it is argued, demonstrates the evolution of similar land use systems and social structures in ecologically similar but globally dispersed environments like the Alps, the Himalayas, and the Andes (Rhoades and Thompson 1975).

Second, *diachronic* analyses emphasize the evolution of pastoralism as a specialized mode of production alongside agriculture (Bates and Lees 1977, Lees and Bates 1974). Pastoralism is seen as an outcome of agricultural intensification resulting from improved irrigation systems. Ultimately, two groups are created: one specializing in cropping at the cost of foregoing stockraising, and the other disengaging itself from cultivation altogether to become pastoralists. Integration of the two activities, which was previously achieved at the household level, now occurs across groups through the exchange of products. Specialization is not absolute, however, and may be altered according to economic, environmental, or political changes. This general model was developed for "traditional" pastoralists, but it seems to hold for many nontraditional and contemporary agropastoral systems as well.

Third, the *dialectic* approach sees integration between the two subsistence strategies as incomplete. They are simultaneously complementary and conflicting due to the inherent constraints and special requirements of each type of production (McCorkle 1983, 1987, this volume; Vincze 1980). For example, coordinating proximity to cultivated fields with herd mobility needs is an almost impossible task. Allocating limited family labor to urgent agricultural chores, while at the same time attending to an active herd, is another source of strain.

Unquestionably, most stock operations are strongly conditioned by their physical environment. Yet ecological explanations fail to incorporate the broader scope of pastoral activities, e.g., marketing and trade, land tenure, and access to pastures. Hjort (1982) claims that ecological models have little explanatory value if they are isolated from their economic, political, and social context; moreover, they can be highly misleading. Likewise, while emphasizing the importance of ecological explanations, Burnham (1980) notes their inadequacy for analyzing African pastoralism. He advocates strengthening ecological approaches with a full understanding of all relevant political, economic, and historical factors.

Indeed, there is now a consensus that in order to understand livestock production systems in modern times, analysis must embrace regional, national, and even international economic and sociopolitical structures and processes (Barth 1961, Bates 1972, Haaland 1971, Irons 1974). As Hjort aptly observes:

> . . . the interface between pastoralism and other economic systems is ultimately formed by the marginal position of the pastoralists in the national political system. Concern for politically important groups in the big urban centres governs the national goals for production in the arid areas, especially production of cheap meat (Hjort 1981:135).

This more comprehensive analytic approach is the one adopted here.

PIURAN ECOLOGY

The Department of Piura spans all three of Peru's major ecological zones (Tosi 1960): *costa*, the coastal plain; *sierra*, the high mountains; and *selva*, the tropical jungle on the eastern slopes of the Andes (Figure 2.1). However, Piura's costa is much wider than the coastal strip south of it (200 km versus less than 50 km); its sierra is much lower than the rest of the Peruvian Andes (3000 m versus more than 5000 m); and its selva is actually a dry, tropical forest rather than a developed, wet forest as in other parts of eastern Peru. The following ecological discussion centers on the coastal plain, where most goat husbandry in Piura is pursued.

The Piuran costa displays two major sub-ecologies: the agricultural valleys, and the scrublands of the despoblados. These are further divided into more or less homogeneous subunits (Perevolotsky 1985a). In the agricultural zone, five such units (1 to 5 in Figure 2.1 and Table 2.1) can be defined in terms of characteristic crops, agrarian sociopolitical organization, and the natural rangelands surrounding the cultivated fields. Table 2.2 presents a cropping profile for the department as a whole. The despoblados manifest four subunits (A to D in Figure 2.1) according to vegetation, including the form and percentage of cover of perennial plants and the frequency of occurrence of ephemerals. The correlation between natural ecozones of the despoblados and annual rainfall, which is in turn a function of distance from the sea and proximity to the mountains (Perevolotsky 1984), is displayed in Table 2.3.

Although Piura lies close to the equator, it is an arid region. Annual precipitation varies from 30 mm near the seashore to about 500 mm in the eastern-most parts of the coastal plain. However, rainfall averages are quite uninformative in arid or semiarid environments because of large interannual variations in precipitation. In Piura such figures are even worse than useless due to the El Niño effect.

El Niño is an oceanographic-climatological quasicyclical (once every 2 to 10 years) phenomenon in which the usually cold water of the Peruvian sea-current is replaced by relatively warm water. This causes a dramatic change in precipitation on the otherwise very dry coast of northern Peru (Glantz 1981, Philander 1983) plus serious disturbances in the marine ecosystem. These acute climatic shifts cause considerable economic damage (Idle 1973, Murphy 1926). El Niño's torrential rains flood the coastal plain, severely damaging agricultural fields and urban areas (Caviedes 1975, Murphy 1926, Renan Iglesia 1975). For example, in the 1983 El Niño, the city of Piura, which averages 50 mm of rainfall annually, received 2200 mm in only six months. El Niño rains and floods also directly impact animal husbandry in Piura. Range resources change dramatically, both quantitatively and qualitatively. Animal productivity and health

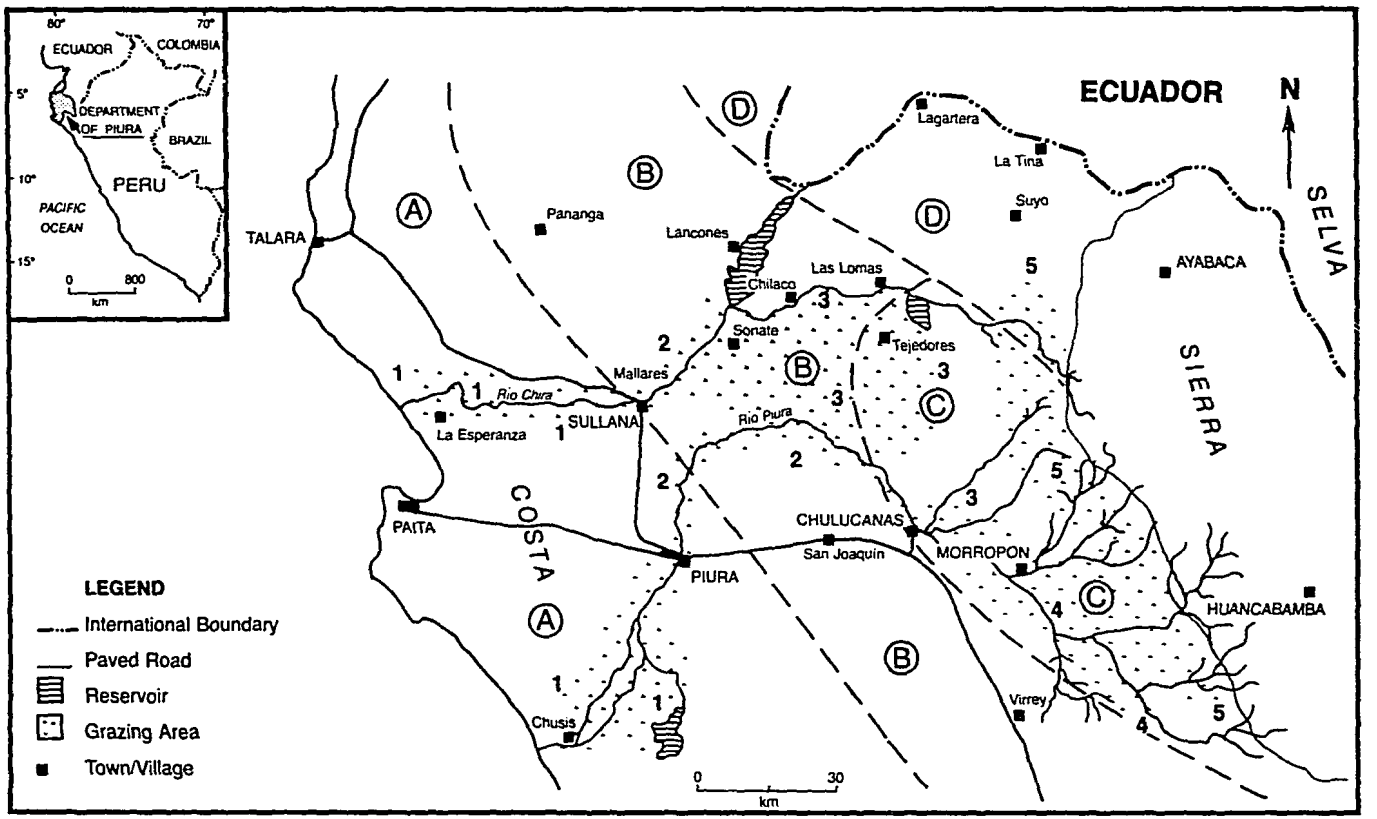

FIGURE 2.1 NATURAL ECOZONES OF PIURA

TABLE 2.1 DIVISION OF THE AGRICULTURAL VALLEYS OF PIURA INTO PRODUCTION UNITS

CODE[a]	LOCATION	AREA (ha)	FARM SIZE[b] (% of area)	PRINCIPAL CROP[c] (% of cultivated area)	STUBBLE AVAILABILITY[d]	AVAILABILITY OF NEARBY NATURAL PASTURE[d]
1	Lower Piura	41,258	Very small (62), medium to large (38)	Cotton (40) and subsistence crops (15)	Sep-Nov	Very low
	Lower Chira	2,000	Very small to small	Cotton (n.d.) and subsistence crops (n.d.)	Aug-Nov	Very low
2	Middle Piura	15,000	Large (90)	Cotton (80)	Sep-Nov	Low to moderate
	Chira	28,000	Large (90)	Cotton (50) Rice (30) Corn (15)	Jul-Oct May-Jul Nov-Feb	Low to moderate
3	San Lorenzo	35,000	Medium	Fruits (40) Cotton (25)	n.a. Aug-Oct	Moderate to good
	Upper Piura	n.d.[e]	Medium	Corn/sorghum (15)	May-Aug	Moderate to good
4	Upper Piura	26,000	Large (75) Medium (15)	Rice (20) Corn/sorghum (40) Cotton (40)	Jun-Aug May-Aug Jul-Oct	Good
5	Western slopes of the Sierra	n.d.	Medium	Tropical fruits, vegetables, corn, rice	n.d.	Very good

[a]Refers to the labeled regions of Figure 2.1.
[b]Very small, <5 hectares (mostly of peasant communities); small, 5-10 ha; medium, 10-100 ha; large, > 100 ha (mostly cooperatives).
[c]Based on data from Plan de Desarrollo Agrícola, Chira-Piura Project, 1975.
[d]Based on observations and interviews with local peasants.
[e]No data available.

TABLE 2.2 CROPPING PROFILE OF PIURA (1980)

CROP	TOTAL HECTARES	PERCENT OF TOTAL[a]
Cotton	43,800	35.0
Rice	20,200	16.0
Maize	19,640	16.0
Fruit Trees	18,700	15.0
Sorghum	14,920	12.0
Beans	3,710	3.0
Cereals	1,500	1.0
Manioc	1,440	1.0
Onion	1,020	0.8
Cultivated forage	800	0.6
Coffee	370	0.3
Sweet Potato	360	0.3
Potato	260	0.2
Total	126,720	101.2

[a]Does not sum to 100% due to rounding.

as well as herders' management and marketing strategies are strongly affected, both positively and negatively, by the abundant rains and pasturage (Perevolotsky 1985b).

Piura is also subject to La Niña, the inverse El Niño, when sea temperatures become colder than usual and the mainland receives even less rainfall than usual (Guillén and Calienes 1981, Namias 1976). In these drought years pastures in the despoblados are bare. Herbaceous vegetation disappears after a short period of grazing, and many shrubs and trees remain dormant all year long. Such dry conditions are detrimental to livestock, especially under an extensive regime that relies on natural resources and has little capital for importing feeds.

Figure 2.2 schematizes the rainfall variability in Piura across 57 years (1926 to 1983) based on meteorological data and on observations of river discharge. Substantial oscillations in weather along the northern coast of Peru are also documented by Eguigurn (1895) and Kosok (1965) for 1791 to 1890 and 1913 to 1948, respectively. Clearly, extreme changes in precipitation have been a dominant feature of the Piuran ecosystem in recent history.

GOAT HUSBANDRY IN PIURA

Piura is the "goatland" of Peru. About 28% (437,000 head) of the nation's goats are reared in this coastal department (Ministerio de Agricultura 1976). Only in the Department of Lima, where demand for meat in the urban markets of the capital is steadily growing, does the caprine population approach Piura's.

TABLE 2.3 NATURAL ECOZONES IN THE DESPOBLADOS OF PIURA

CODE[a]	LOCATION	RAINFALL[b] (mm)	VEGETATION	PLANT COVER (%)	DOMINANT SHRUBS AND TREES	FREQUENCY OF EPHEMERALS[c]
A	From seashore to Sullana and Piura (40-70 km)	30	Very dispersed, low shrubs, xerophytes	3	Zapote (Cappris scabrida), bichayo (Cappris avioenmi folla), algarrobo (Prosopis sp.)	Very low
B1	Mallares, Angolo, Poechos		Dense groves in dry rivers, dispersed shrubs and trees on hills	20	Algarrobo, overal, charán, hualtaco (Laxopterygium huasango)	
B2	Nomala, Piura, San Lorenzo (60-70 km)	80-120	Diffuse perennial vegetation, medium-size trees, low and medium-size shrubs, intensive tree cutting	17	Faique (Acacia sp.), overal, (Cordia rotundifella), zapote, algarrobo	Moderate
C	From Chulucanas and Pan American Highway to the slopes of the mountains (40 km)	200-250	Diffuse cover of high shrubs and trees, dense herbaceous cover after rains	40	Overal, zapote, algarrobo	Good
D	From San Lorenzo and Poechos to the border with Ecuador (40 km)	250-500	High cover of many diffuse shrubs and trees, dense herbaceous cover almost every year	75	Charán (Caesalpinea corymbosa), overal, mosquera (?), añalque (?), pasayo (Bombax sp.), ceibo (Bombax sp.), palo santo (Burcera graveolana), borrachera (Ipomaea carnea), and many more	High

[a]Refers to the labeled regions in Figure 2.1.
[b]Annual averages; data obtained from SENAHMI (Servicio Nacional de Meterorología y Hidrología) and from the Chira-Piura project.
[c]Based on interviews with herders living in each ecozone as to the percentage of years in which ephemerals develop.

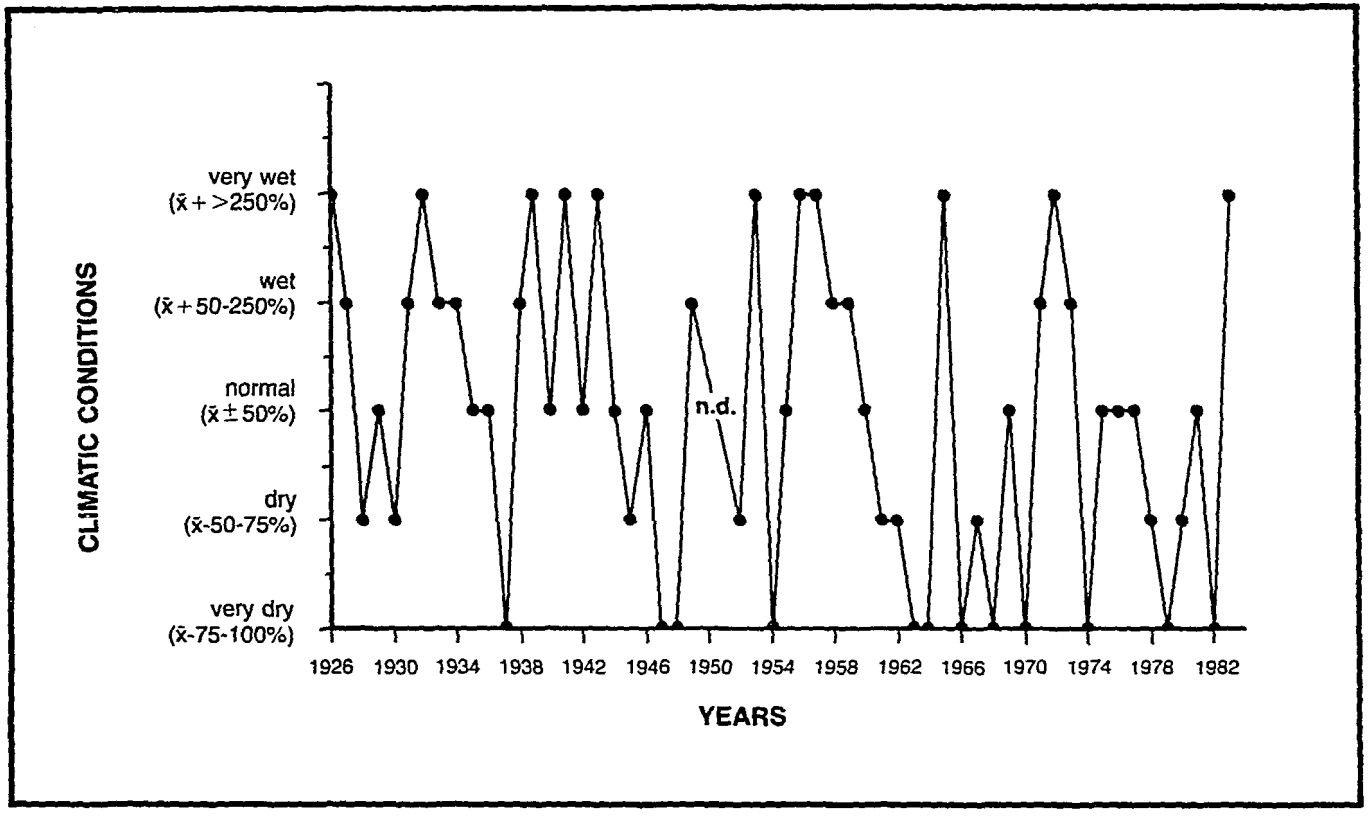

FIGURE 2.2 CLIMATIC CONDITIONS IN PIURA, 1926-1983

Unfortunately, official census figures on goats in Piura are not available beyond 1976. In any case, such data as do exist seem highly inaccurate. Different and perhaps more objective measures like the volume of goat hides traded annually from the department suggest an estimated 520,000 head in the region as a whole (Perevolotsky 1985a). This figure is 20% more than official estimates.

If it is difficult to determine the number of goats in Piura, it is even more difficult to estimate the number of herders. First, the question of who exactly *is* a herder must be answered. Should anyone who owns a couple of goats be considered a *ganadero* (herder)? Or only people whose main source of income is goatherding? Or should all *campesinos* 'peasants' residing in the despoblados be counted as herders? There are no clear-cut answers nor any solid data on the number and distribution of Piuran ganaderos. The only available figure derives from the Ministry of Agriculture report cited above, which records 20,300 to 20,800 families of "active" herders in Piura in 1972–1976.

The present study adopts a heuristic definition of Piuran herders as people who derive their principal source of subsistence from livestock, especially goats, whether or not they farm as well. "Farmers" will refer to peasants whose main activity is cropping, while "ganaderos" glosses the more purely pastoral residents of the scrublands where cultivation is extremely limited. In any event, knowing the number of goats or herders in Piura tells us little about actual husbandry techniques or production processes. An inclusive survey of livestock operations in Piura revealed seven to nine distinct goat production systems (Perevolotsky 1984, 1990). Three principal factors distinguish these systems: the ecological setting, the economic status of the household, and the sociopolitical sphere of the individual operation (Tables 2.4 and 2.5).

More specifically, each system manifests the following characteristics: a "production factor" that integrates herd size, composition, annual kidding rate, and average number of kiddings per year; a typical management routine; and a distinct marketing strategy. Since each system operates under different conditions or within different spheres, constraints on livestock production or economic returns vary by system. In general, for ganaderos the main limiting factors are pasture and water in dry years or seasons, plus aperiodic predation, disease, and marketing difficulties. For farmers who keep goats, labor availability and capital are the principal constraints (Table 2.6).

For both groups, feed availability is critical. The caprine diet in Piura includes natural pasture (herbaceous or shrubby), crop stubbles (preferably cotton) or residues (e.g., rice straw), concentrated feed (e.g., cottonseed cakes), cultivated forage (e.g., Sudan grass), and other supplements (e.g., pods of the algarrobo tree, *Prosopis juliflora*). In the despoblados, caprine diets are supplemented only when dry herbaceous vegetation is scarce. The need for supplementation increases if herds do not migrate in the summer to the stubble fields in the river valleys. But each ganadero designs and redesigns the diet of his herds within

TABLE 2.4 SYSTEMS DESCRIPTION: AGRICULTURAL LANDS

ZONE	SYSTEM CHARACTERIZATION	SYSTEM LOCATION	PRINCIPAL SUBSISTENCE SOURCE[a]	HERD SIZE AND COMPOSITION (mean and s.d.) Goats	Sheep	Cattle	PRINCIPAL FORAGE SOURCE
R	Small farmers, comuneros,[b] very arid environment (ecozone A)	Lower Piura valley, lower Chira valley	Mixed: cash crops, foodstuffs, and livestock (100%, n = 6[c])	8 ± 9	2 ± 2	4 ± 10	Jan-Jun: roadside vegetation. Jul-Dec: stubble.
S	Moderate-size farms, comuneros,[b] favorable environment (ecozone C and mountain slopes)	Upper Piura valley, western slopes of sierra, Quiroz valley	Mixed (100%, n = 24)	67 ± 88	11 ± 18	16 ± 6	Nov-Jun: natural pasture. Jul-Oct: agricultural residues and by-products.
T	Cooperative members	Mostly mid- and upper Piura and Chira Valleys	Monthly salary, private cropping plots (100%, n = 18)	23 ± 14	6 ± 5	3 ± 5	Jan-Jun: natural pasture near agricultural area. Jul-Dec: stubble.
U	Wage laborers (no land) from agricultural valleys. Mostly non-comuneros	Everywhere in the agricultural valleys	Wage labor or sharecropping (67%, n = 19)	43 ± 39	11 ± 8	5 ± 10	Same as T.

[a]Percentages refer to the number (n) of herders surveyed.
[b]Members of legally recognized peasant agricultural communities.
[c]Although only six herders were actually interviewed here, additional information was gathered in the local slaughterhouse and from Ministry of Agriculture censuses.

TABLE 2.5 SYSTEMS DESCRIPTION: DESPOBLADOS

ZONE	SYSTEM CHARACTERIZATION	SYSTEM LOCATION	PRINCIPAL SUBSISTENCE SOURCE[a]	HERD SIZE AND COMPOSITION (mean and s.d.) Goats	Sheep	Cattle	PRINCIPAL FORAGE SOURCE
V	Goat herders, no permanent cropping, live on state land, unorganized politically	Despoblados of Sullana, Angolo, Pariñas	Goat raising (76%, n = 31)	84 ± 57	5 ± 9	3 ± 7	Jan-Jun: natural pasture. Jul-Dec: stubble (migration).
W	Goat herders with occasional rainfed agriculture; mostly "peasant groups" in dense, dry savanna	Las Lomas - Suyo-La Tina region	Goat raising (71%, n = 24)	102 ± 92	3 ± 7	4 ± 5	Natural pasture all year round.
X	Goat herders, no cropping, comuneros,[b] semi-arid environment (ecozone B-C)	Despoblados of Pabur, and western Olmos	Goat raising (78%, n = 19)	55 ± 57	11 ± 15	3 ± 6	Same as W.
Y	Goat herders, occasional rainfed cropping, comuneros,[b] dry savanna (equivalent to ecozone C-D)	East Olmos; Salas (Dept. of Lambayeque)	Mixed livestock and rainfed agriculture (n = 29)	40 ± 33	5 ± 11	3 ± 5	Same as W plus agricultural residues if enough rainfall occurs.
Z[c]	Milk producers	Typically on urban outskirts	Goat raising, selling milk (75%, n = 10)	118 ± 109	8 ± 15	5 ± 10	Mar-May: natural pasture Jul-Dec: stubble and supplements

[a] Percentages refer to the number (n) of herders surveyed.
[b] Members of legally recognized peasant agricultural communities.
[c] Z systems are semi-intensive.

TABLE 2.6 MARKETING ASPECTS AND LIMITING FACTORS IN GOAT PRODUCTION SYSTEMS

SYSTEM ZONE	SELL MILK	SELL CHEESE	SELL KIDS	AGE OF KIDS SOLD	TIME MOST KIDS SOLD	LIMITING FACTORS
Agricultural Systems						
R	No	No	Yes	No regularity	Jan-Mar	Pasture, capital
S	No	No	Yes/no[a]	No regularity	Nov-Dec	Labor, predation, abortions
T	No	No	Yes	11-15 months	Mar-May	Labor/manpower, pasture
U	No	No	Yes	No regularity	No regularity	Pasture/stubble, diseases
Despoblado Systems						
V	No	Yes	Yes	2-5 months 6-10 months	No regularity	Pasture and water during dry years, capital for concentrates, labor during migration
W	No	Yes	Yes	8-12 months	Mar-May	Pasture and water during dry years, diseases, predation
X	No	No	Yes	n.d.	All year	Pasture and water during dry years, diseases, cheese marketing, poisonous shrubs (borrachera)
Y	No	No	Yes	n.d.	No regularity	Pasture during dry years, diseases, predation, cheese marketing
Z[b]	Yes	No	Yes	0.5-2 months	All year	Availability of natural forage, stubble, capital and credit

[a] Ordinarily do not sell kids, except in very dry years or when necessities arise.
[b] Z systems are semi-intensive.

TABLE 2.7 CHARACTERIZATION OF HERDERS VERSUS FARMERS

	PARCEL SIZE	CROPPING REGIME	PRINCIPAL CROPS (%)	MEAN HERD SIZE		
				Goats	Sheep	Cattle
Herders (n=19)	3.4 ha	Temporary	Maize (17) Manioc (13) Yam (12)	98.7	8.1	8.5
Farmers[a] (n=22)	4.9 ha	Permanent	Maize (13) Rice (8) Fruit trees (8) Manioc (6)	44.7	23.5	9.2

[a]A majority of interviews were held in the most favorable ecozones of Piura.

and across years according to his economic situation and the availability of natural forage near his home (see following sections).

To summarize, goatherding is an important economic activity for the vast majority of Piuran peasants. Goats are the principal source of meat for peasants and an important one for urban populations as well. Goat meat constitutes 50% and 20% of all animal protein in the diet of rural and urban Piurans, respectively. But the primary product of most goat herds in Piura is kids. These are marketed at different ages according to environmental conditions and the economic status of the owner (Perevolotsky 1986). Cheese is a secondary product; it is marketed seasonally if and when milk production is sufficient and markets are accessible.

While goatherding is pursued mainly by ganaderos of the despoblados, many farmers also raise goats. Herd size, production, husbandry practices, and marketing strategy are determined by the overall economic, environmental, and sociopolitical conditions of the operation (Table 2.7). However, most Piuran herds are raised under an extensive management regime characterized by heavy reliance on natural resources, low inputs of capital, and thus little dietary supplementation or veterinary care.

INTEGRATION BETWEEN CROPPING AND HERDING IN PIURA

Integration or conflict between subsistence activities can be examined from the perspective of the region of production or the unit of production (here, the family/household).[2] Regional integration can be examined in three further contexts: a "pure" ecological approach combining environmental conditions with production requirements and management; an historical perspective emphasizing the origin and evolution of current practices and relations of production; and a broader context encompassing important social, economic, and cultural factors as part of the "operational environment" of the production system (after Barth's

1973 use of "total environment" to include sedentary people as part of pastoralists' environment).

Integration at the Regional Level

Ecological. Perevolotsky 1987 took this approach to agricultural and pastoral integration at the regional level, claiming that the dynamic demographic exchanges and the production-related interactions so common between Piuran ganaderos and farmers are actually adaptations to the effects of El Niño on both cropping and stockraising. Meteorological, hydrological, and historical evidence indicates that every decade will see at least one severe disturbance in Piura's environment, whether the devastating floods of El Niño or the searing drought of La Niña, or both. Floods on the big rivers destroy poor farmers' small fields, which are usually located on river banks. Deprived of their main subsistence source, these unfortunates may move to the despoblados to try to start a new life as hired herders or as ganaderos, taking with them the small goat herd they had in the agricultural zone. Conversely, a severe drought can decimate despoblado herds, which must rely upon natural forages. When this happens, ganaderos may migrate to the cultivated river valleys or temporarily entrust some of their stock to a farmer under a shareherding agreement. This regional-level integration of cropping and herding represents an adaptive response to climatic capriciousness, especially in arid or semiarid environments.

Regional integration also contributes to the efficiency of each production process. Grazing herds on crop residues, stubble, and byproducts greatly enhances their diet, especially when ephemeral vegetation withers. The quantitative and qualitative importance of Piuran agriculture in providing fodder for animals is suggested in Table 2.2's crop data. In return, livestock manure the intensively cultivated fields (Jamtgaard 1983, McCorkle 1983, Vincze 1980, Winterhalder et al. 1974). Reportedly, 40% of the world's farmers rely on animal dung for fertilizer (McDowell 1981). Given these productive efficiencies, it is hardly surprising that agriculturalists and pastoralists the world over commonly agree to use cropping areas as temporary grazing grounds, thus respectively securing supplies of fertilizer and seasonal pasturage. Piura is no exception.

Of course, regional integration of cropping and herding calls for a high degree of cooperation between geographically separated and managerially conflicting production systems. In Piura, cooperation is achieved through sociocultural mechanisms. Kinship ties, *compadrazgo* 'co-godparenthood' relations, and individual or communal fiestas are some of the means by which logistic assistance, pastures, or temporary livestock care are accessed (Perevolotsky 1985a, 1987).

Historical. Although valuable, the foregoing environmental and synchronic analysis permits only a partial understanding of how agricultural and pastoral systems are integrated. An evolutionary and historical perspective is needed

to construct a more comprehensive picture of the way the two sectors are interwoven.

Archaeological studies indicate that a developed, irrigated agriculture existed in Piura's river valleys long before the Spanish conquest (Lanning 1967). There is also some evidence of traditional camelid husbandry in the region (Estete 1924, cited in Cook 1981; Rostworowski 1981). But the archaeological record is silent on the subject of interactions between the two subsistence systems.

The early Spaniards' chronicles of the northern coastal plain of Peru praise its pasture potentials; in particular, they mention the algarrobo tree and its pods as a very promising source of fodder (e.g., de la Calancha 1639). Sheep, goats, cattle, donkeys, and mules—the *ganado de Castilla* 'Spanish livestock'—quickly became an essential part of agriculture in the area. The early *encomienda*[3] and later the *haciendas* 'private estates' appropriated much of the productive land in Peru (Keith 1976). Initially, they pursued both plant and animal agriculture. However, more and more early estate owners turned away from cropping and toward ranching, for a variety of reasons, including the growing demand for Old World livestock products, Peru's vast unexploited grazing grounds, and an economic crisis in the cropping sector due to Indian depopulation and hence a rapid decline in available labor.

In Piura, legal allocation of Indian laborers to Spanish landlords began in 1589 and was soon entrenched as a way of ensuring a steady supply of pastoral labor to raise inexpensive meat for the urban market (Perevolotsky 1985a). Although all rangelands in Peru were declared a communal resource in 1541, this only facilitated estate owners' continuing political machinations to strip Indians of their traditional rights to land and win exclusive control of grazing grounds (Keith 1976). However, an estate owner usually allowed peasant herders to exploit the hacienda's vast pastures in the despoblados in return for an annual tax of 6% to 12% of their herd in cash or kind. The herders also had to help oversee the estate's stock and gather a certain quantity of algarrobo pods for its animals. Peasants who permanently lived and worked on the estate were allowed to cultivate a small parcel on its property and to keep a few livestock of their own to supplement the extremely low wages they received from the landlord.

In the mid-19th century, these landlord-peasant relations underwent a significant change in Piura. The trigger was the introduction of cotton. By the turn of the 20th century, cotton covered more than 75% of the land cultivated in Piura; it is still the department's number-one crop (Table 2.2). Since cotton was (and is) produced primarily for export, it stimulated an agrarian revolution that transformed the extensive ranching system of the haciendas into a highly mechanized and capitalized plantation operation. Suddenly, longstanding labor arrangements between haciendas and peasants became an obstacle to development, since the limiting factor on intensification was units of land as large as possible. Conflicts arose between landlords who now wanted back the use of much of their estate, and the tenants and sharecroppers for whom the same land

was their sole source of subsistence. Moreover, plantation agriculture required fewer, but more professional, permanent personnel (Collin-Delavaud 1967). Yet it also demanded a massive seasonal work force, especially for pest-control and cotton picking campaigns.

In northern Peru, where most cotton was produced, the pastoral sector of the neighboring despoblados was seen as the answer to these needs. Under the new plantation system, the vast pasturage outside the irrigated fields was of little value to estate owners since they no longer kept much livestock. Owners therefore did not mind letting former tenant farmers graze their herds on estate property, especially if this facilitated the owners' recapture of arable lands. To "their" ganaderos, landlords extended exclusive grazing rights to the cotton stubble fields *gratis*;[4] for an annual fee, ganaderos could also utilize the estate's rangelands in the despoblados. In return, landlords expected both groups—the former tenants and the ganaderos—to help with the cotton harvest. The mutual advantage of such arrangements was clear. Landlords won sociopolitical (land tenure) tranquility and at the same time assured themselves of a cheap supply of seasonal labor from herders. The latter obtained a stable subsistence base plus exclusive access to a nutritious and highly desirable fodder during the driest season of the year. Additionally, working in the cotton fields at harvest time placed little burden on ganaderos since this was when they normally migrated from the drying scrubland to the agricultural zone anyway.[5]

These longterm land use practices may also explain the lack among ganaderos of long-distance migration or transhumance between different natural habitats (see, e.g., Mendes and Narjisse this volume), even though Piuran ecological conditions permitted, and livestock management was favored by, such moves. All pasturage belonged to haciendas. The only movement that landlords permitted their ganaderos was from the scrublands to the cultivated fields at harvest time. Migration of herders from one hacienda's rangelands to another's was forbidden, since this would defeat the purpose of securing a plantation labor force.

In Piura, these historical events provide a fuller context for understanding systemic interactions between peasants and landlords, and between cropping and herding. The region's history did not give rise to two specialized occupational sectors, as Lees and Bates' model postulates. Instead, interrelationships evolved in a sociopolitical sphere in which a small but powerful commercialized agricultural sector controlled the main factor of pastoral production (pasturage) plus many other aspects of stockraising including labor, markets, and technology. The pastoral sector, although larger, evolved at the mercy of an agricultural elite and thus has been very weak politically.

The Broader Context. Among other things, the sociopolitical and economic changes described above caused individual patron-client ties to replace earlier, generalized interactions between estates and indigenous communities (Perevolotsky 1985a). The key to stable, longterm patron-client relations was for landlords

to perpetuate individual peasant's complete dependency upon their patronage and to generate an on-going competition for their favors among peasants. The outcome was segregation and alienation or "social atomization" (McClintock 1979) of the traditional peasant community. These structural relations impaired herders' later attempts at communal action or social mobilization (Perevolotsky 1983), for example, during the 1969 agrarian reform (see below).

In short, the corporate structure so typical of traditional Andean communities was radically altered in Piura. Therefore, there is no reason to expect strong communalism, territoriality, or political organization among present-day ganaderos. Likewise for any interaction between farmers and herders at the community level, as corporate social groups. Instead we now find individualized contacts.

Integration at the Household Level

Integration between the two productive regimes is valuable not only as an adaptation to region-wide environmental vagaries, but also as a strategy for peasant households to cope with uncertain economic and sociopolitical "weather." Most economic decisions are made within the family; but peasant families are subject to many economic and sociopolitical factors beyond their control and sometimes even their comprehension, e.g., pricing policies for essential materials, marketing restrictions, tax laws, credit availability, or monetary fluxes like inflation or devaluation. The relative economic benefits of cropping versus herding may change across time and space due to shifts in one or more of these factors.

In Piura, crops provide peasants with basic foodstuffs (manioc, yams, maize, vegetables) and/or the money with which to purchase the rest of the family's diet (mostly rice, beans, and potatoes). Smallholders with some non-agricultural income (e.g., wage laborers, cooperative members, and herders) are engaged, first of all, in raising crops for home consumption. Others, like community members in the poorest agricultural zones, are forced to raise cash crops such as cotton in order to support their families.

To appreciate agropastoral integration at the household level in Piura, it is useful to outline the various functions of goats in the Piuran peasant economy. These include: (1) longterm "insurance policies"; (2) inflation-proof, longterm capital savings; (3) shortterm savings; and (4) a ready credit line. These same functions have been noted for small ruminants throughout the world among both pastoral and agropastoral groups (Barth 1964, 1973; Brandstorm et al. 1979; Dahl 1979; Dahl and Hjort 1976; McCorkle 1983; Primov 1984).

With regard to (1) and (2), goats are particularly favored by peasants for several reasons. First, under arid conditions goats can survive and produce better than any other animal domesticate. They are also less susceptible to disease in dry climates. Moreover, goats are a relatively low-cost investment that, under

favorable environmental or economic circumstances, yields maximum interest (Primov this volume). In (3) and (4), goats and sheep represent an easy way to free up capital because they can be readily cashed in to obtain the relatively small amounts of money peasants usually need. Cattle may be more attractive and prestigious investments, but they oblige the peasant to liquidate large sums of money. In other words, small ruminants are an effective, flexible, and highly fungible economic asset. They provide more investment opportunities for poorer groups than do other livestock. This explains why small ruminants are so popular as "animal savings accounts" among peasants. In Piura this preference is captured in the local saying, "La cabra es la vaca de los pobres" 'The goat is the cow of the poor.'

Although Piuran peasants operate smallscale, subsistence-oriented farms under unstable conditions, some households do accumulate surplus capital. The problem such fortunate families face is how to retain the value of their extra money. Lack of investment opportunities in agriculture plus sociocultural inhibitions on using modern financial institutions make livestock an especially attractive form of savings. There are still other advantages to animal savings accounts. One is their built-in thrift value (Barth 1964, 1973). This results from the need to save some newborns to replace older animals. Since replacement rates are extremely unpredictable in most pastoral systems, the habit is to minimize sales or home consumption. In other words, selling or consuming certain livestock products (young animals) may threaten the productive base itself (the herd). In contrast, marketing or consuming agricultural produce has no effect on the productive potential of land. Another economic advantage of livestock over cropland is their accumulation value. Animals are an active source of capital; they produce interest in the form of new animals. Land, productive as it may be, has no direct interest factor. It cannot produce more land.

A quantitative analysis of slaughterhouse records and field surveys in Piura (Perevolotsky 1986) reveals how peasants vary their goat-marketing strategies depending on production processes, ecological location, and specific conditions like drought versus abundance of rain and forage. Ganaderos minimize marketing in abundant years in order to build up their herds. This constitutes a sort of insurance policy; keeping large herds represents an adaptive response to the region's frequent droughts, which can engender herd losses of up to 50%. Only pastoralists who curtail consumption, maintain large herds, and thus prudently practice a livestock insurance strategy, will remain in business in the long run.

In contrast to the despoblado herders, the mixed farmers of the river valleys deploy livestock in a shortterm-savings and capital-manipulation strategy. Farmers residing in favorable environments, like the slopes of Piura's western sierra, use goats to store surplus capital from cropping. Since pasturage in this region is quite abundant and stable over time, herds may increase rapidly. But labor constraints force these peasants to regulate herd size. From time to time, they cash in animals and invest the money in real estate (e.g., a second house in the

city), improvements to the cropping enterprise (more arable land or farm infrastructure), or family well-being (e.g., health and education).

Poor peasant-farmers, who are mainly found in the driest western regions of the department, use goats as a ready source of credit. These households raise cotton in a semi-intensive process that requires capital for seasonal purchases of seed, pesticides, and extra labor. Since these farmers lack access to institutional credit, the family herd must serve instead. Local slaughterhouse data show that during the growing season the flow of animals from the villages is very low; livestock must therefore be "imported" from other districts. However, when preparations for the next cropping season begin, these peasants' goat marketing increases sharply (Perevolotsky 1986). The longterm existence of this dual, mixed-farm form of integration is achieved by keeping culling rates lower than kidding rates, on average. Table 2.8 displays peasants' different uses of goats in the various ecological zones and production unit types of Piura.

CONFLICTS BETWEEN CROPPING AND HERDING IN PIURA

Agriculture and pastoralism are in conflict almost by definition. Pursuing one substantially reduces the possibility of practicing the other. Like integration, conflict can be examined from two perspectives: the group or sector, and the individual household.

Conflicts at the Group Level

Land tenure is obviously a sectoral issue. It is also one of the most significant non-biological factors in crop and/or livestock production since it determines property title, land use rights, and access to or cost of forages. Exclusive control over forage resources all year long affords stockowners a certain security and greater management options. Lack of control over feed resources leaves the herder at the mercy of others, and therefore limits or even dictates his management mode, e.g., migration. Dependence on resources (pastures, water, and migration routes) that are owned by others almost always imposes extra costs in money, time, and energy on stockraisers and/or restricts their production process in certain ways (Bates 1972).

In Piura, the impacts of land tenure on goatherding are evident in a comparison of the pre- and post-agrarian reform periods. Previously, ganaderos solved the land tenure problem by exchanging their labor on cotton plantations at harvest time for grazing rights in the despoblados during the rest of the year. True, herders held no title to these rangelands. Moreover, they were forced to pay an annual fee for their use. Nevertheless, the ganaderos were at least assured of exclusive rights to rangelands. Any encroachments by neighboring herders were rebuffed by the hacienda.

TABLE 2.8 THE USE OF GOATS IN DIFFERENT REGIONS OF PIURA

REGION	ECOLOGY	AGRICULTURAL ORGANIZATION	PRINCIPAL CROP	PRINCIPAL USE OF GOATS
Upper Piura	Stable and favorable (250-500 mm)	Individually owned medium-size fields (comuneros and cooperatives)	Maize, fruit trees, sorghum	Saving capital produced by cropping
Middle Piura/ Chira	Dry savanna, unpredictable rainfall (100 mm)	Mostly large and medium-size fields of cooperatives	Cotton, rice, maize	Secondary income, emergency fund
San Lorenzo	Moderate, dense savanna; more predictable conditions (200 mm)	Mostly medium-size individually owned parcels (private property)	Fruit trees, rice, maize	Savings
Lower Piura	Very dry (25-50 mm)	Small individually owned fields (mostly comuneros)	Cotton	Credit source for cotton cropping
Despoblados (dry)	Trees in dry rivers, variable conditions, unpredictable rainfall (100 mm)	Rainfed (once every 5-7 years), individually owned, small plots	Maize, manioc	Main source of subsistence
Despoblados ("wet")	Dense savanna, stable conditions (250-500 mm)	Rainfed (once every 1-2 years), individually owned, medium-size plots	Maize	Subsistence, savings, emergency fund

In 1969, however, the agrarian reform granted tenant farmers title to a plantation's arable lands and re-organized the tenants into agricultural cooperatives. But ganaderos living on the despoblados of the dismantled plantations were excluded from cooperative membership. At the same time, control of the despoblados was transferred to the government. In practice this made these rangelands ownerless. The relevant official agencies do not have the power, the budget, or the means to exercise authority over this resource. The result is that today's ganaderos must compete for green pasture with wealthy ranchers who drive their cattle to the despoblados in abundant years. And in dry years, the

herders watch helplessly as wood merchants from the city chop down the algarrobo trees that are essential to stockraising in the scrublands (Perevolotsky 1983, 1985a).

Land reform also affected herds' seasonal access to stubble. Previously, exclusive grazing rights encouraged herders' use of hacienda stubble fields, protected ganaderos against competition from fellow herders, and ensured landlords a harvesttime workforce. But today, most of the large stubble fields are controlled by agricultural cooperatives. Unlike the former haciendas, the co-ops never lack for labor, even during the cotton-picking season. On the contrary, some cooperatives have too many workers. Moreover, many co-op members own livestock (mostly goats) and prefer to use the fodder themselves rather than share it with herders who are nonmembers. Since management decisions about access to co-op resources are taken by communal institutions (committees and the general assembly), members are naturally given priority. However, many cooperatives are in financial trouble, and more than a few are on the verge of bankruptcy. A majority of co-ops have therefore decided to rent out their stubble fields, often at higher fees for nonmembers than members.

In short, the agrarian reform deprived herders of their exclusive rights to nearby stubble. Moreover, in some cases they lost access to this resource altogether, while in others they were required to pay stiff rental fees.

Conflicts at the Household Level

Conflicts over the allocation of limited family labor to cropping versus herding are a feature of agropastoral systems the world over (Dyson-Hudson and Dyson-Hudson 1980, Jamtgaard 1983, McCorkle this volume, Vincze 1980). Among Piuran ganaderos, virtually the entire family is involved in running the livestock enterprise. Two to four children are responsible for herding different age groups of livestock. The mother is in charge of milking and cheese-making, perhaps with the help of a daughter, while the father attends to marketing and to emergencies like predation, disease, and rustling. This task structure is fairly fixed, unlike other parts of Peru (Fernández this volume). Despoblado herders are unable to devote any household labor to cultivation unless the family is extraordinarily large, or unless the herd is quite small.

Migration can also be examined from the conflicted perspective of a pastoral family forced to divide its limited human resources. Stretching the family labor pool spatially is a problem for many ganaderos. The critical time is the dry season, when part or all of the herd must migrate to the agricultural zone. Some family members remain in the despoblados, while others (usually two or three older children) move with the herd. The importance of logistic and labor assistance for pastoralists migrating to the agricultural region is detailed in Perevolotsky 1987. A more recent migrational problem is the move of part of the family to a regional city. Parents often send their children to urban centers

in hopes that they will find better educational opportunities. In many cases, the family establishes a cheap adobe house in the periurban *pueblos jóvenes* 'young towns.' The mother, infants, and schoolchildren reside in the city while the father and the other children remain in the countryside to tend the herd.

The labor situation among farm families is no better. The cropping enterprise periodically demands all available family labor; yet extensive herding is also an on-going, labor-intensive business (McCorkle this volume). Thus, labor constraints determine the maximal size of farmers' herds. These households also face the problem of splitting the labor force spatially. In years of good rainfall, they cannot spare a family member to migrate with their livestock to the rich, green pastures of the despoblados, far from their fields. Finally, farmers who keep goats must also consider two further problems: disputes over the creatures' damage to neighbors' crops, and the constant threat of rustling so common in heavily populated and readily accessible areas like the cultivated river valleys.

SUMMARY

Reviewing the relationships between cropping and goatherding on Peru's northwestern coast, it is evident that peasants can more efficiently exploit this complex ecological space either by pursuing both of these activities simultaneously or by specializing in one while maintaining mutually productive relations with specialists in the other. Interrelations between the two sectors of production represent an adaptation to unstable conditions in a number of respects: ecological (dramatic changes in rainfall and pasturage), economic (both regional and national), and political (estate-peasant relations, the agrarian reform and its consequences).

Whether at the regional level or the household level, integrating cropping and herding facilitates abrupt "career changes" on the part of Piuran peasants, as need arises. When one of these two sectors is in crisis, resources from the other sector can be mobilized to sustain or re-initiate it. In the process, household sources of food and money are supplemented and multiplied. Flexibility in subsistence sources and high diversification across available sources are important for peasants' ability to adapt to an unstable economic environment. A classic example is Haaland's (1971) description of Sudanese households that shift between agriculture and nomadic pastoralism or alter their dependence on each in response to environmental and economic changes.

Particularly from the economic perspective of the household, there are considerable advantages to, and thus persistent attempts at, combining the two types of production. The peasant agropastoralist diversifies his food sources, exploits natural resources more efficiently, improves his ability to withstand environmental or economic crises, and increases production in each system with inputs derived from the other. In other words, he maximizes survival capacity. However, the importance of this integration between agriculture and pastoralism

should not obscure the very real conflicts between them. These arise on three levels: both for the region and the community, access to pasture is the predominant source of conflict; for the household, labor allocation in time and space is the greatest strain.

NOTES

1. This chapter is based on 16 months' field research conducted as part of the SR-CRSP Sociology Project under Grant No. AID/DSAN/XII-G-0049 in collaboration with Peru's Instituto Nacional de Investigación y Promoción Agraria, with additional support from the University of Missouri-Columbia and the University of California-Davis. The assistance of Michael Nolan, Benjamín Quijandría, and Keith Jamtgaard during fieldwork was invaluable.

2. However, this is not to belittle the socioeconomic role of the community in production processes (Orlove and Custred 1980).

3. The encomienda was a title granted to the first Spanish settlers. It authorized them to collect tax in kind, money, labor, or personal service from Indians of designated regions.

4. In Peru the model of exclusive grazing rights in return for seasonal work seems to hold only for Piura, due to unique ecological conditions (vast rangelands bordering huge cultivated fields, plus favorable climatic and hydrological features) coupled with a specific agricultural development (modern cotton plantations).

5. Mohammed (1973) describes similar arrangements between pastoralists and sedentary agriculturalists in the Sudan, where the former are recruited as seasonal workers on the latter's cotton fields. Likewise, Sorbo (1977) documents how commercial agriculture depends on cheap labor from the pastoral sector in another part of the Sudan. He concludes that "The tenant and the nomad are really one and the same person."

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3

THE ROLE OF GOATS IN AGROPASTORAL PRODUCTION SYSTEMS OF THE BRAZILIAN SERTÃO[1]

George Primov

The goal of most livestock development projects is to help producers raise more and better animals. Such projects assume that the purpose of livestock production systems is simply to produce livestock. Presumably, if a producer did not desire a particular animal, he would not produce it. By this token, the existence of a production system for any given species is regarded as *prima facie* evidence of its desirability. Further, the more widespread its production in a region, the more important it is presumed to be. But these assumptions can lead to misunderstandings about the logic of the livestock production system for a given species, particularly vis-à-vis other animal and plant crops in an agropastoral adaptation. This lack of understanding can result in ineffective or even counterproductive development projects.

The basic error lies in assuming that the animal is always more important than its system of production. Livestock projects are usually more concerned about assessing the relative advantages of different species than of different production systems. This approach is correct when production is primarily geared to market sales. But what happens when the reasons for producing the livestock are largely unrelated to the animal's commercial value, or when the overall system of plant and animal production is more important to the producer than the specific products it yields? These are not rhetorical questions. Goat production in northeast Brazil is a case in point.

THE BRAZILIAN SERTÃO

Northeast Brazil largely consists of a semi-arid, 1,542,271 km² plain known as the *sertão*. The sertão is characterized by low rainfall (rarely more than 1000 mm annually) and a highly adapted xerophytic vegetation cover. Most of the sertão typically does not receive rain for at least six consecutive months each year; i.e., there is a very marked dry season. The vegetative cover, locally known as *caatinga*, is dominated by deciduous or succulent woody species. In some areas it consists mainly of trees and shrubs, while in others it is composed primarily of dwarf shrubs and cacti (Howell 1981, Pfister et al. 1983). These ecological conditions have led to an adaptive agropastoral system based on the intensive production of crops and the extensive production of livestock by small, isolated farm units. Cropland is created by clearing the caatinga, while livestock are grazed on the caatinga.

Although cropping strategies are very similar throughout the region, cultivation patterns are closely adapted to local soil and water conditions. The goal of each producer is to plant as many crops as possible in order to minimize risk. Cash crops include cotton, castor beans, and watermelons. However, the bulk of cultivation is directed at meeting subsistence needs. The principal foodcrops in the sertão are beans, corn, manioc, and several varieties of squash. With the exception of manioc, these staples are very seldom sold; they are mostly consumed in the household. Indeed, most households do not produce enough for their own needs and thus are forced to buy additional supplies in the market. The need to increase agricultural output obliges most producers to expand their fields by clearing more caatinga. Even though land is usually available, farmers' labor resources limit the amount of land they can clear or plant. Farm households may be large, but they seldom include more than two or three adult males. In consequence, few farmers of the sertão cultivate as much as five hectares in any year; most plant far less.

With regard to animal agriculture, northeast Brazil has approximately eight to nine million goats, seven to eight million sheep, and about 20 million head of cattle (Agropecuaria Tropical 1982). Cattle tend to be concentrated within the medium and large production units, while small ruminants, especially goats, are most often found on the smaller farms. Goat meat is a staple in the rural diet as well as an important source of cash.

Livestock survive primarily by grazing and browsing in the caatinga. During the dry season, however, they are often unable to find sufficient forage. As a result, stockowners are forced to plant forage species like *opuntia* (spineless cactus) or some type of grass. In fact, as much as a quarter of a family's cropland may be devoted to forage production (Mason 1980). Because agriculture is usually incapable of meeting household subsistence needs or providing an adequate cash income, people rely heavily on pastoralism to generate cash.

Almost every producer in the sertão owns animals. (For additional detail on sertão agropastoralism, see Neumaier 1986 and Primov 1984.)

RESEARCHERS, PRODUCERS, AND PRODUCTION SYSTEMS

The large number of goats in the sertão and their ubiquity among small and medium producers has led the Brazilian government to initiate a concerted effort to improve goat production in the region. As part of this effort, the government established the National Center for Goat Research in 1977. In 1980, the Center entered into a longterm cooperative research agreement with the Small Ruminant Collaborative Research Support Program. The goal of this joint research program has been to increase goat production through improvements in local husbandry systems. Expatriate and Brazilian researchers both regard sertão systems of stockraising as rather primitive and inefficient. They hope to increase herd quality and productivity by developing management systems that utilize current inputs more efficiently and by introducing new inputs. Developers are well aware that most producers have very limited financial resources and cannot afford to adopt tools and techniques that require substantial investments of capital. Thus, researchers strive to design inexpensive strategies that primarily rely on additional inputs of labor. There is, therefore, a conscious effort to identify and develop improvements that lie within the technical and financial reach of the majority of the region's agropastoral population.

Brazil's new caprine research program represents a genuine attempt to come to grips with the realities of rural production in an impoverished area of the Third World. Unfortunately, this effort can be vitiated if researchers do not understand producers' motives for raising a given mix of plant and animal species. Scientists are prone to assume the existence of a production strategy that in fact does not correspond to that of many stockraisers in the sertão (see below). Observing that local systems of goat production are highly inefficient compared to more advanced systems, that flock health and nutrition are woefully inadequate by modern standards, and that the animals are usually unsupervised, researchers' reactions are automatic. Their solution is to "modernize" the animal husbandry system through the rationalization of labor inputs and moderate increases in capital inputs. Their task, as they see it, is to convert the current "primitive" and inefficient systems into modern and efficient ones that will produce more and better goats, thereby increasing aggregate goat production and theoretically improving producers' economic welfare.

Two factors reinforce this uncritical orientation toward development. First, as in many Third World countries, agricultural scientists in Brazil have an official mandate to increase national crop and livestock production. The Brazilian government's concern to stimulate small ruminant production is two-pronged: to meet the food needs of its ever-growing urban population; and to export

animals, especially to the high-demand markets of the Middle East in order to earn much-needed foreign exchange (Kasprzykowski 1982).

The second factor influencing the types of solutions sought by researchers is more ideological. Whether in cropping or stockraising, developers almost invariably regard increased production as a way to create surpluses for sale. Sales are supposed to generate greater gross profits for producers—profits that, even after allowing for the higher costs of more intensive production, represent a larger net income. Thus, expanded production is equated with improved producer welfare. The possibility that such a strategy may be unattractive or even non-viable for the farmer/stockraiser is seldom considered. Nor is it questioned whether increased integration and interdependence with the national money economy is really advantageous for producers, especially during inflationary periods.

In sum, researchers appraise systems of goat production in northeast Brazil and elsewhere in relation to models of market economies. Local systems are judged inefficient because they do not respond to the goal of market production. There is no serious consideration of the possibility that there may be other, more appropriate models for evaluating production systems.

These market-oriented assumptions explain the strategies that are developed to "improve" local systems of animal husbandry. These systems' lack of fencing, precise pasture rotation schemes, controlled breeding, preventive health care, careful range management, and so on, are automatically regarded as significant deficiencies that must be remedied. The remedies, of course, require increased labor and capital. But in researchers' view, this is only a shortterm problem because producers should recover all investments through increased sales. The challenge is merely one of how to keep inputs as low as possible. Scientists correctly estimate that Brazilian goat producers are not able to invest in high levels of capital inputs; but they go on to assume that producers would be willing to do so if they could.

Producers, on the other hand, often have a very different vision of what they are doing and why. Although they are well aware of market conditions and price structures, these factors are not the primary determinants of their goat production strategies. Most agropastoralists of the sertão respond first and foremost to household needs. Thus, when they sell goats in the market, they are responding not to current market conditions but rather to current subsistence necessities. Their market behavior is therefore very different from that assumed by researchers. There is a crucial difference between raising goats for profit and raising them for periodic sale in order to meet recurrent cash needs. In the latter case, production does not respond to price incentives, whereas in the former, rising livestock prices stimulate production increases. In fact, in the much-debated "backward-bending supply curve," higher prices may allow subsistence-oriented producers to sell *fewer* goats and still meet their cash needs.

This behavior is linked to a second factor—many Third World producers' preference for accumulating wealth in animals rather than in cash (see Perevo-

lotsky this volume). There are good reasons for this preference. People of the sertão point out that the price they are paid for a live goat is significantly lower than the total market value of the animal's byproducts. In the long run, prudent producers resist the conversion of their animal wealth into cash. This is especially true under current economic conditions in Brazil and many other developing nations, where inflation devalues currency almost daily. In this situation, present systems of goat production in northeast Brazil are almost inflation-proof. Stockraisers avoid the steadily rising cost of purchased inputs, and they benefit from the higher prices for livestock. The producer participates in the market economy solely as a seller with no investment risks. It is very difficult, to say the least, to improve upon this strategy.

UNDERSTANDING SERTÃO PRODUCTION SYSTEMS

There is strong agreement among the producers of northeast Brazil that goats are the best livestock for the sertão, mainly because they can survive the region's recurrent droughts much better than sheep and cattle (Shelton and Figuerido 1981). Goats are also considered the easiest livestock to manage. People devote little labor and almost no capital to raising them. Goats survive on very little feed; they provide a cheap source of meat, milk, and skins; they are readily marketable; and they are a good hedge against inflation. It is small wonder that goats are the most popular type of livestock in the sertão.

When these advantages are scrutinized more closely, however, it becomes apparent that they largely spring from the system of production rather than from the animal itself. Since goats require almost no capital inputs, household consumption of their meat and other byproducts costs stockraisers nothing. The household can eat goat meat without eating into its financial capital. Similarly, the sale of goats represents almost pure profit. Having such hardy, "cost-free" animals gives producers great flexibility in utilizing them, and allows stockraisers to enter the marketplace in a favorable position. This is all the more true because the demand for goat meat greatly exceeds supply. At present, people can sell their goats any time they choose. This same flexibility helps explain why market prices provide little incentive to expand goat production and why strategies for upping production are likely to fail if they rely primarily on market mechanisms as incentives.

The absence of strong production-related financial incentives to sell goats is reinforced by other characteristics of the production system. Goats exploit lands that, because they are almost entirely unfenced, are in effect common grazing grounds. Since producers are not constrained by a lack of rangeland, they have little incentive to limit their herds. Although a few goats die of malnutrition because of the extreme scarcity of forage during the dry season, under rangestock operation these mortalities cannot be prevented simply by controlling herd numbers. In fact, people try to maximize herd size so that as many animals as

possible will survive the droughts, since stockowners incur no costs by doing so. Given this strategy, if producers have to choose between *more* goats versus *better* goats, they will opt for the former. Herd size determines accumulated wealth and potential meat supply. Of course producers will welcome improvements that enhance quality without significantly increasing production costs. Otherwise there is little reason to adopt them.

Yet, the only circumstance in which improvements in animal quality might be desirable is for market sale; and it is not clear that improved animals would command proportionately higher prices in the market. On the whole, people buy goat meat not because it is preferred, but because it is cheap. It should be emphasized that these Brazilian agropastoralists are not averse to participating in the market or even to producing exclusively for it. While most agropastoralists of the sertão sell only a small percentage of their goat herds, many cultivate some crops, like cotton, solely for sale. Similarly, many keep cattle. Households utilize the milk, but never the meat, from their cattle; ultimately, the animals are always sold. The household's orientation, then, is not resistance to market production but rather selective participation in it. The operating principle behind households' cropping and stockraising seems to be that the more a given plant or animal species requires capital inputs, the more likely it is to be sold rather than consumed.

For example, sheep—which require more labor and capital inputs than goats—are sold far more often than goats. Producers in the sertão regard sheep as relatively delicate animals. Stockowners point out that sheep require constant care and supervision, and that they must be given supplemental feed during the dry season. Also, sheep are very expensive to buy. On the other hand, mutton is preferred to goat meat. The market reflects this fact by pricing mutton 20% to 40% higher than goat meat. People raise sheep partly because they prefer to eat mutton and partly because, with some luck, they may be able to control their production costs and realize a good profit. Some stockraisers feel that, even under average climatic and market conditions, sheep are actually more profitable than goats. However, most producers report that they earn more from selling goats than sheep, despite the latter's higher market prices.

The lesson here is that, as with different plant crops, sheep and goats are raised under different strategies and for different reasons. In fact, the sheep production system in northeast Brazil much more closely resembles the model assumed by researchers for all livestock production.

CONCLUSION

We can now understand some of the difficulties in the types of recommendations that researchers make. There is a central contradiction between developers' assumptions and producers' strategies regarding goat production in northeast Brazil. Recommendations that increase the complexity and cost of the

production system eliminate the principal incentive for raising goats. For most agropastoralists of the sertão, there would be little reason to keep goats if they had to devote significant levels of labor and capital to them. Faced with such recommendations, stockowners of the sertão are likely to do one of two things. Either they will ignore researchers' and extension agents' advice because it is impractical and will continue to produce goats under the current system; or they might apply some of the recommendations to improving their sheep or cattle production, instead.

This does not mean that little can or should be done to assist such producers with their goat husbandry; but it does mean that it is first necessary to determine what truly constitutes an improvement within a given production system. Marginal improvements in animal production and productivity based on moderate increases in labor inputs might be much more helpful than major improvements based on increases in capital inputs. Agropastoralists in northeast Brazil are most interested in maximizing the size of their goat herds. While they may be averse to investing inputs, especially capital, in improving the quality of their goats, they are much more willing to make investments to keep the animals alive.

Technical assistance goals should be congruent with this production rationale. They should help stockowners to maintain as many goats as possible in a manner that minimizes capital investment and maximizes the returns to labor. Small improvements brought about under such conditions may afford great benefits. The criterion for successful development should not be whether the financial potential of the goat herd has improved, but whether the economic well-being of the household has been bettered.

A more serious issue is whether researchers can adjust their pre-existing assumptions to the realities of smallholder production, not only in Brazil but throughout the Third World. Scientists must be willing to help these farmer-stockraisers with subsistence, as well as market, production if development is to succeed (Conelly this volume). Developers must be able to comprehend and keep firmly in mind the distinction between the welfare and interests of the producers and the economic interests of urban consumers. All too often, development programs are implemented solely to increase agricultural outputs for the benefit of urban consumers, under the guise that the programs simultaneously benefit rural producers. This myth must be replaced by a more equitable understanding of the different and often contradictory interests of both groups. Such an approach might result in development projects that actually work.

NOTES

1. The research on which this chapter is based was carried out as part of the USAID Title XII SR-CRSP under Grant No. AID/DSAN/XII-G-0049, in collaboration with the Empresa Brasileira de Pesquisa Agropecuaria, Centro Nacional de Pesquisa de

Caprinos e Ovinos Tropicais. Additional support was provided by the University of Missouri-Columbia. The chapter represents a greatly revised version of Primov 1985.

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4

RANGE-ANIMAL ECOLOGY AND AGROPASTORALISM IN MOROCCO'S WESTERN HIGH ATLAS MOUNTAINS[1]

Lloyd Mendes and Hamid Narjisse

Agro-sylvo-pastoralism is a widespread system of land use in the mountains of the Mediterranean region. This system has two components: intensive, subsistence agriculture practiced on small, terraced plots; and small ruminant production on much larger, non-arable marginal lands. Flock productivity is usually low since the animals must rely primarily on forests and rangelands for feed. However, this system is well-adapted to harsh environments where the prospects for significant production improvements are dimmed by unfavorable climate and isolation from markets. Morocco's western High Atlas Mountains are representative of this mixed system of land use. The inhabitants of this region cannot survive solely on the limited, arable area. Therefore they also raise livestock on the surrounding ranges. The pastoral production system is well-adapted to local ecological constraints and requires only minimal, though seasonally critical, inputs of forage from the agricultural component of the mixed farms.

This chapter first discusses the most critical feature of range-animal ecology in a representative high-mountain valley of Morocco's western High Atlas: the inadequacy of arable land. Second, it describes how local shepherds adapt to this montane ecology by moving their flocks over a gamut of ecological zones and how they respond flexibly to intra- and inter-annual changes in ecological relationships. Third, following this traditional logic of range ecology adaption, some realistic directions for livestock development in the Atlas Mountains are outlined.

THE RESEARCH SETTING AND METHODOLOGY

The research site is the Imenane, a high valley ranging from 1600 m to 3800 m and located about 50 km south of Marrakech at 7° 50′ W and 31° 10′

N. The Imenane lies in the Rherheya watershed, which drains into the Oued Tensift from the north slope of the mountains (see Figure 4.2). The inhabitants, Tichlehit-speaking Berbers, are sedentary agropastoralists. The present study examines small ruminant production in the upper two-thirds of the Imenane watershed, where irrigated agriculture predominates over dryland cereal cultivation.[2] The study area also incorporates the Haoz Plains (200 to 600 m) around Marrakech, which form part of the mountain/plains complex exploited by Imenane flocks.

Agricultural production is based on a yearly rotation of corn in summer and barley in winter. Also, permanent meadows are irrigated and sown with cultivated grasses that are harvested for hay in summer and grazed for regrowth in winter. There are also improved pastures. In addition to flocks of sheep and goats, most families keep one or two dairy cows and a mule or donkey. Cattle and equines are fed almost exclusively from the irrigated fields or from feed imported into the Imenane. The physical environment, culture, and production methods of the Imenane are broadly typical of the eastern, higher end of the western High Atlas (Bencherifa 1983:273–279).

Two types of data were gathered in this study: regional data and case studies of particular households. A regional overview of the research area was obtained from maps, aerial photos, meteorological records, and tax rolls of livestock holdings. Watershed and irrigated field surfaces were planimetered on a map and on aerial photos, respectively.[3] While these sources are reasonably representative of large areas, they serve primarily as indicators of orders of magnitude. To capture more specific relationships between land and livestock, in-depth case studies of the agropastoral production systems of six key-informant households in the upper Imenane were conducted. These six households were selected to represent the diversity of livestock holdings and valley ecology in the Imenane. However, there is an inadvertent over-representation of wealthier households in this sample.[4] Since the data are not statistically representative, except where noted otherwise, they are treated as a census of each household and analyzed as simple percentages. In mid-winter of 1985, each household head was asked to recall for the previous year and to predict for the coming spring his forage and grain production and consumption and the movements of his household's flock. At the same time, the shepherd was asked to recall parturitions and deaths within each animal "lineage" in his flock. Taken together, this information furnished the broad outlines of small ruminant production in the households studied.

THE INADEQUACY OF ARABLE LAND

In the western High Atlas Mountains, steep topography, poor soils, and low rainfall limit arable lands to narrow, irrigated valley bottoms. With gradients averaging 20% to 30%, the mountain slopes are hardly stable even if undis-

turbed. Soils in most of the upper watershed are coarse-grained and shallow to bedrock. Even where soils are finer and deeper, rainfall is relatively low, averaging only 370 mm per year over the past eight years.[5] Though some dryland barley is cultivated, these conditions restrict most agriculture to the irrigated 2% of the watershed surface.

Agricultur based solely on this small irrigated area cannot meet the current human popu'ation's needs. Population density in the region is high: 35 persons per cultivated hectare (calculated from Chami 1982:12,16) or roughly 0.6 ha of irrigated land per taxed household in the Imenane (calculated from aerial photos and tax rolls.) For centuries, the inhabitants have depended on the adjacent Haoz Plains around Marrakech for grain, their food staple (Berque 1955:58). Traditionally, the mountain people's strategy has been to import a large part of their grain, purchasing it with money earned from exporting their labor and livestock to the plains (Bourbouze n.d.:196). This is still the case in the Imenane Valley. In the 1984–1985 agricultural year, for example, most of the study families produced only 10% to 20% of their estimated grain needs. Moreover, of the 13,000 kg of grain consumed in these homes over the same year, only 2000 kg, or about 20%, were produced in the Imenane Valley.

The agropastoral household keeps large numbers of livestock in relation to its limited arable land surface. The 284 households of the Upper Imenane owned 9834 small ruminants in 1979, an average of 35 head per household. They also kept 625 cattle, or about two head per household. Calculated on the basis of 200 ha of irrigated land in the valley, this equals about 50 small ruminants and three head of cattle per irrigated hectare. In addition, many families keep a mule or donkey. It is impossible for all these animals to derive the bulk of their nutrition from the small, irrigated land area. Instead, flocks must be herded on native ranges during most of the year (Figure 4.1). A few animals are allowed to graze the irrigated terraces, but only in winter (see Table 4.4).[6] In 1983–1984 most small ruminants derived their nutrition yearround from native ranges; all depended on range forage for at least half, and more commonly, three-fourths of the year.

PROBLEMS AND OPPORTUNITIES OF RANGE-ANIMAL ECOLOGY

Exploiting mountain rangelands involves more than simply herding animals outside the arable perimeter and hoping they will find forage. Rangestock production presents special problems and opportunities. The problems can be avoided and the opportunities exploited only by understanding range-animal ecology. In the Imenane, this ecology is characterized by sharp differentiation over short distances, by cyclical production processes, and by climate and thus uncertain production from year to year.

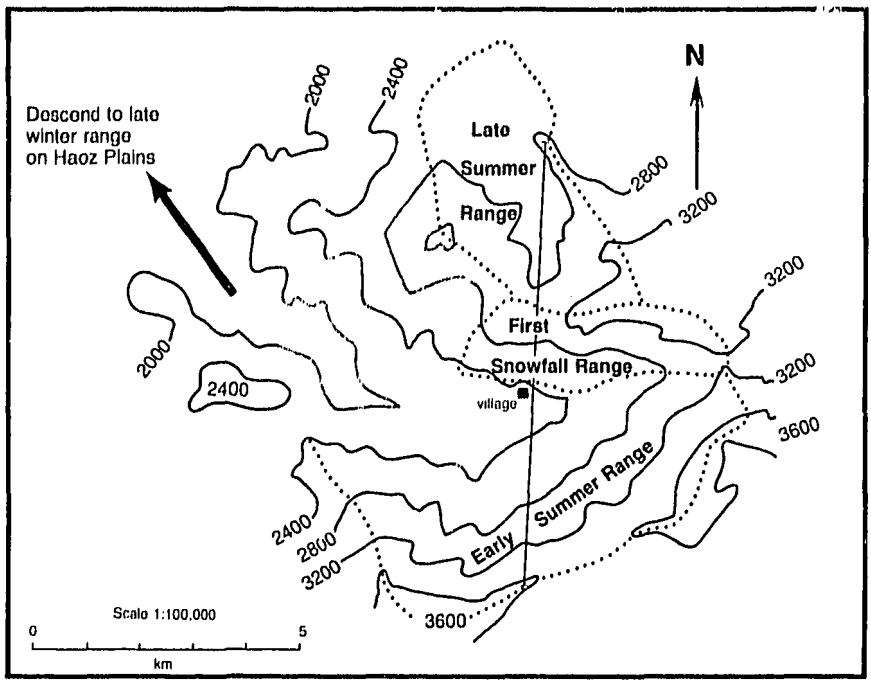

FIGURE 4.1 LOCATION OF SUMMER AND EARLY WINTER RANGES OF TACHDIRT FLOCKS[a]

[a]Legally or traditionally enforced boundaries in the Imenane Valley are shown by dotted lines. The N-S solid line represents the transect of elevations shown in FIGURE 4.3. Map traced and elevations transferred from Division de la Carte (1972).

Ecological Differentiation over Short Distances

From the peak of Mount Jbel Aksoual (3842 m) to the Haoz Plains at 470 m and 50 km away, the rangelands exploited by Imenane flocks manifest great ecological variation. This variation along the elevation axis of the mountain/plains complex is termed a vertical ecology (see also McCorkle this volume). In such ecologies, temperature naturally decreases with altitude. To illustrate, a 1000 m meteorological station in the Rherheya watershed records an annual average temperature of 17° C; at a 2100 m station, this figure drops to 13° C (Chami 1982:5). Conversely, precipitation in the watershed increases with elevation. This is due to the orographic effect of the Atlas Mountains, which forces moist air coming from the Atlantic Ocean to rise. This effect is evidenced in the average yearly precipitation records of four meteorological stations at different elevations in the Rherheya watershed (Table 4.1).

Coupled with other factors like geologic formations, these differences in temperature and precipitation result in different vegetation zones across the

TABLE 4.1 PRECIPITATION AND ELEVATION IN THE RHERHEYA WATERSHED (10-YEAR AVERAGES)[a]

METEOROLOGICAL STATION	ELEVATION (m)	PRECIPITATION (mm)
Neltner (3207 m)	3000	896
No station	2500	n.d.
Aremd (1900 m)	2000	609
Asni (1200 m)	1500	459
Tahanaout (900 m)	1000	330[b]

[a]Source:Chami 1982:5.
[b]Two-year average only.

vertical ecology. The warm, dry plains are sparsely covered with desert shrubs; annual herbs and grasses spring up for only a short time, just after the winter rains. The highest elevations in the watershed (above 2400 to 2500 m) are alpine zones dominated by small spiny shrubs interspersed with low, sparse forbs and grasses during the short growing season. An intermediate zone, at about 1600 to 2400 m, is dominated by forest, with oak at lower elevations and juniper at higher altitudes (Chami 1982:10).

Even within the same narrow band of elevation where the ecology is generally similar (e.g., in the alpine or forest zone), there are differences in micro-climate. South- and west-facing mountain slopes are warmer than those that face north or east, even though they are only several hundred meters apart. Average temperatures in turn affect forage availability over the year. For example, south-facing slopes are snow-free in winter but they are dry and less productive in summer. Just the opposite is true for north-facing slopes. Upper Imenane shepherds exploit these micro-climatic differences in the mountains by herding flocks on north-facing slopes in the summer and saving the south-facing ranges for winter.

In sum, there is great ecological variation within a short distance. In the mountains, this is expressed as a vertical ecology. In contrast, in the Sahel for example, such variation is expressed as decreasing rainfall from south to north or as desert versus adjacent river delta. In all these cases the juxtaposed ecological zones have alternate seasons of environmental stress. This juxtaposition presents opportunities for herds to avoid stress by shifting between ecozones. Agropastoralists of the High Atlas exploit these opportunities by moving their flocks over the entire vertical axis of the mountain/plains complex (See Figure 4.5).

Cyclical Production

Another characteristic of range ecology is the cyclical nature of range-animal production. Two kinds of cycles are involved: annual climatic or seasonal cycles, and the cycle of animal reproduction.

Seasonal Cycles. The climate on the north side of the Atlas is Mediterranean, with winter precipitation and summer drought. Depending on the temperature regime at different elevations, forage grows mostly on the plains in the winter and in the mountains in spring and early summer. Forages decline in availability thereafter as they are grazed. Because of these climatic differences, mountains and plains have different cycles of forage availability. The desert plains of the Haoz, though dry in summer, provide succulent annual growth in late winter.[7] Above the tree line, where deep snow prevents winter grazing,[8] shrubs and herbaceous plants provide green forage late into summer. The middle-elevation oak and juniper forests provide a yearround, if low quality, supply of browse for goats, plus emergency feed that can be cut and hauled to temporarily snowbound sheep and goats in winter.

Berber agropastoralists adapt to these major seasonal changes in forage availability along the axis of their vertical ecology by transhuming. They move their sheep and goats up to the highest elevations in summer; then in late winter they move the animals down to the plains (Figure 4.2). When herding on the mountains, they also exploit the smaller differences in microclimate by grazing flocks on the cooler, north-facing slopes in summer and on the warmer south-facing slopes in winter. The grazing pattern of one household flock in the high-altitude (2200 m) village of Tachdirt illustrates this seasonal flexibility (Table 4.2).

However, even in a single major ecological zone like the mountains, forage availability varies, declining over the winter. Observations of goat diets in a forested part of the central High Atlas Mountains revealed that while dry matter intake remained constant over winter, energy intake decreased between October and April (Bourbouze n.d.:155). This suggests that goats are forced to select less nutritious plant parts in winter. We can assume that forage and energy intake are worse for sheep, which do not browse as readily as goats. Winter forage availability and energy intake for both species are probably even poorer in the alpine zone, where forest browse is unavailable.

An important cultural adaptation to the decline in forage availability is the use of range reserves (Gilles et al. 1986, Mendes 1987). Communal ranges are closed to grazing at particular times of the year in order to save forage for other seasons. These deferments may be policed by communal or legal sanctions. Flocks from the village illustrated in Figure 4.2 use two such deferred, communal ranges. One is the late summer range, or *agdal*, of Oukaimeden; the other is the first-snowfall range (*azimz*) near the village (Figure 4.3). These communal institutions postpone the use of stipulated grazing grounds from summer, when forage is abundant, until fall and early winter when it is in short supply.

Another seasonal cycle affecting livestock production is the incidence of diseases. Shepherds observe sudden deaths in spring among sheep that change diet quickly from dry forage on the plains to succulent forage in the mountains. The symptoms are those of enterotoxemia or "overeating disease," which results

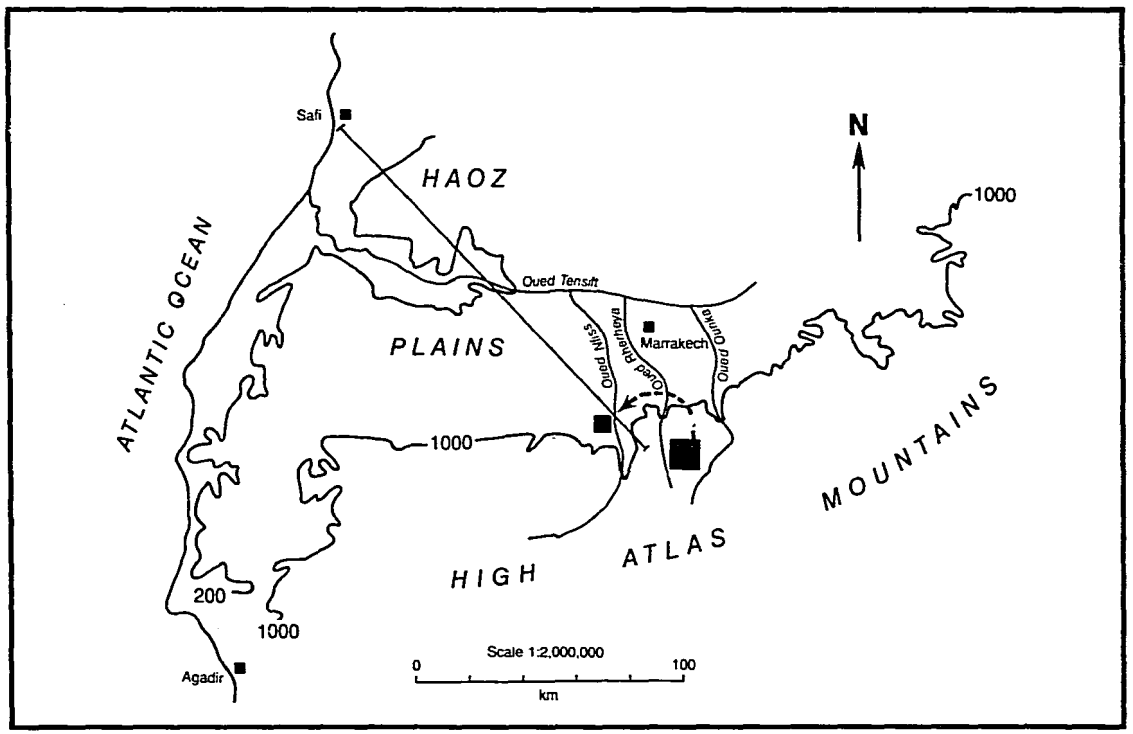

FIGURE 4.2 LATE WINTER TRANSHUMANCE OF ONE FLOCK FROM THE IMENANE VALLEY TO THE HAOZ PLAINS[a]

[a]The NW-SE solid line represents the transect of elevations shown in FIGURE 4.5. Map traced and elevations transferred from the Geographical Section of the Generai Staff (1942).

TABLE 4.2 A TYPICAL HOUSEHOLD GRAZING REGIME

SEASON	FLOCK GRAZING LOCATION
Early summer	North-aspect mountain above tree-line; flock based one hour from village, at 2200 m.
Late summer	High-mountain transhumance to communal grazing reserve above tree-line; flock based three hours from village, at 2600 m.
First snowfall	South-aspect communal grazing reserve above tree-line; flock based in village, at 2200 m.
Late winter	Reverse transhumance of sheep to Haoz Plains (200-600 m) in years of adequate winter precipitation; flock based one week from village. Goats remain in village after first snowfall.

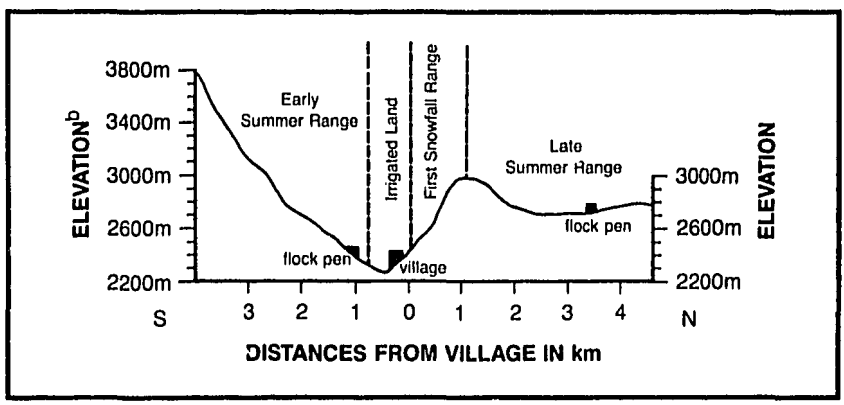

FIGURE 4.3 ELEVATION PROFILE OF SUMMER AND EARLY WINTER RANGES OF TACHDIRT FLOCKS IN THE UPPER IMENANE VALLEY[a]

[a]The early summer flock pen (nirt) shown on the profile lies farther west. The transect shown in FIGURE 4.1 runs N-S through Tachdirt village.

[b]Vertical exaggeration of 2.5X.

when animals are precipitously placed on high-carbohydrate diets. Shepherds endeavor to avoid such sudden changes in forage quality by leaving the Haoz Plains in early spring, before the range plants have reached senescence, and gradually walking their flocks up to higher elevations.

Liverfluke infestation in sheep and goats also occurs seasonally. Sheep that die in winter often show severe fluke damage when their livers are opened. Because ruminants are infested by ingesting the fluke's intermediate host, a land

TABLE 4.3 SHEEP AND GOAT MORTALITY

	PERCENT[a] OF FLOCK BY TWO-MONTH PERIOD[b]							
	Oct-Nov 1983	Dec-Jan 1984[c]	Feb-Mar 1984	Apr May 1984	Jun Jul 1984	Aug-Sep 1984	Oct-Nov 1984	Dec-Jan 1985
Sheep	10	11	0	1	0	0	0	2
Goats	0	9	0	0	0	0	2	1
Lambs	NP[d]	24	0	0	NP	NP	0	21
Kids	NP	26	0	0	0	0	0	88

[a]Adults are expressed as a percentage of adult flock at each period. The adult flock is a composite of four household flocks from Tachdirt and Tineghourine that varied from 272 to 329 head over the 16-month period of data collection. Lambs and kids are expressed as percentage of each period's parturitions.

[b]By two-month periods in the Felahi, or Julian, calendar, which counts 13 days later than the Western, Gregorian calendar.

[c]In the winter of 1984, flocks did not transhume.

[d]NP = no parturitions in this period.

snail found in moist meadows, the main infestation likely occurs on the late summer range. Only here do small ruminants graze marshy pastures during a season warm enough to allow snail activity. The ingested larvae mature in the ruminant's liver in two or three months, during which time they can cause considerable damage (Belschner 1965:650–657). Local shepherds have no effective, traditional way of avoiding or treating fluke infestation, which they claim kills many sheep in winter.

The study reported here lacks the experimental data to ascribe livestock deaths in winter to specific causes such as inadequate forage, cold stress, or parasitism. However, limited data do show that flock mortality is highest in mid-winter (Table 4.3), when the mountains are cold and snowbound and the plains have not yet sprouted enough new forage for flocks to transhume.

Animal Reproduction Cycles. The climatic cycle and the closely related cycles of forage availability and parasitism follow a seasonal, twelve-month pattern. But the small ruminant reproductive cycle, which determines the timing of forage needs, lasts only five months from breeding to parturition, or eight months from initial breeding through parturition and lactation. Ewes' and does' nutritional condition is critical at two times during the latter, eight-month cycle: at breeding and during lactation. Ewes and does do not breed unless they are in good condition; this is the basis of the practice of pre-breeding supplementation, or flushing, of ewes. Lactating females must also eat well enough to produce adequate milk for their young. At other times, good nutrition is not so critical, at least for sheep, because they can draw on and later replenish body-fat reserves (Spedding 1970:110).

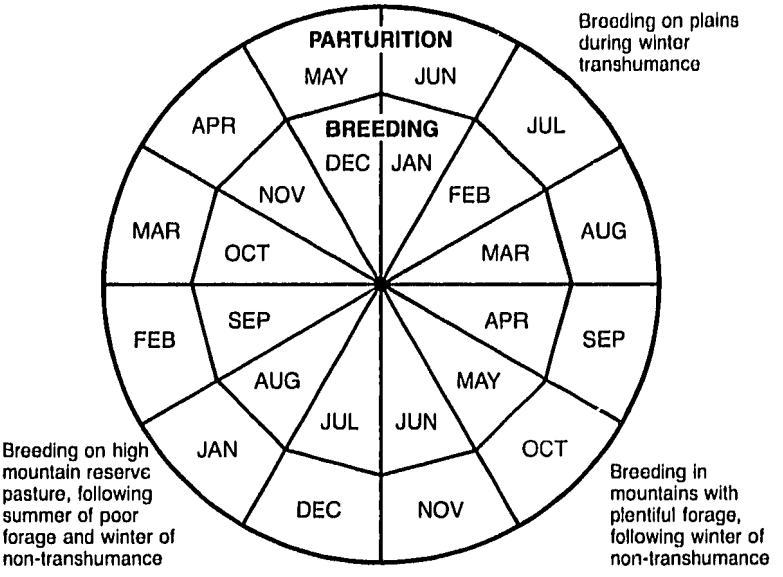

FIGURE 4.4 SHEPHERDS' BREEDING/PARTURITION SCENARIOS OF ALPINE-ZONE SHEEP

For races of sheep raised in the high latitudes where they originated, their reproductive cycle and hence their nutritional needs roughly coincide with the seasons and with forage availability. In these latitudes day length varies and, if ewes are adequately nourished, estrus coincides with shorter day length. Thus, ewes breed in fall and lamb in spring when forage is usually sufficient for lactation (Spedding 1970:77–78). However, nearer to the equator, many races of sheep mate throughout the year, depending on nutritional status. This seems to be the case in the western High Atlas. SR-CRSP research revealed a peak of parturitions in one year due to breeding in July and August, plus another peak in the next year due to breeding in May. Rainfall and therefore forage supply had changed, and hence also breeding. Evidently day length was not so great a factor. Under these conditions, the flock's need for forage may not always match the seasonal cycle of forage availability. The cycles of forage availability and animal reproduction obviously coincide initially; otherwise breeding could not occur. But animal condition five or more months later may or may not be good enough to allow lactation, depending on the season and on the meteorological vagaries of any one year.

Imenane agropastoralists recognize several possible breeding periods for sheep, depending on the pattern and amount of precipitation and the resulting supply of range forage (Figure 4.4). In an ideal year, flocks transhume in February or March and breed on the temporarily lush Haoz ranges. Ewes bred

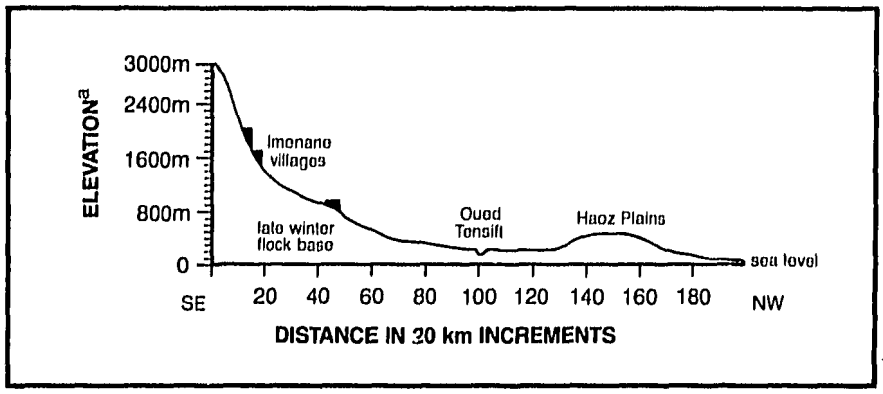

FIGURE 4.5 ELEVATION PROFILE OF A TYPICAL IMENANE TRANSHUMANCE PATTERN

[a]Vertical exaggeration of 2.5X.

then will lamb from July to September when the flocks are on high mountain ranges. Shepherds consider this a good parturition season because ewes are well-fed enough to lactate for the nursing lambs.

When flocks have not transhumed, but mountain ranges produce abundant spring forage, shepherds expect some breeding in May and June. Ewes bred at this time will lamb in October and November, when the flocks have descended from the high alpine ranges down to village level (Figure 4.5). This is considered a bad lambing season, because the poorly fed ewes, pastured on overgrazed village ranges, cannot produce enough milk for their lambs.

Finally, there are years of low precipitation in which flocks cannot transhume to the plains in winter and breed there; neither can they breed in late spring in the mountains if range forage is inadequate. In these years, shepherds expect most breeding to occur on the high mountain range in late summer. This range has been protected from grazing until August so that flocks will find relatively abundant forage there even in low rainfall years. Since ewes bred early on the high mountain range will lamb in January, before the flocks have transhumed to the plains, lamb mortality from cold and starvation will be high (Table 4.3). This is therefore considered the worst parturition season.

Ewes bred late on this high mountain range will lamb in February or March. If the flocks have not transhumed to the plains by then, the parturition season will be no better than in January. The supply of mountain forage and ewes' milk will be poor, and lamb mortality will be high. But if adequate winter rain permits transhumance, February and March lambs will be born on the rich ranges of the Haoz Plains. Shepherds consider this the best of all lambing seasons, and data support their assessment. For example, of 17 lambs born in

TABLE 4.4 SMALL RUMINANTS SUPPLEMENTED WITH IRRIGATED PASTURE

	PERCENT OF HOUSEHOLD FLOCK SUPPLEMENTED			
HOUSEHOLD	Oct-Nov 1983	Dec-Jan 1983-84[a]	Feb-Mar 1984	Apr 1984
1	0	30	30	9
2	0	20	20	1
3	0	0	0	0
4	0	100	0	0
5	0	30	40	40
6	30	30	30	0

[a]1983-1984 was a winter without transhumance, due to low rainfall on the Haoz Plains. Therefore, the flocks remained in the Imenane throughout the winter. Practically no small ruminants grazed irrigated pastures from May to September 1984.

one flock before transhumance at the beginning of February 1985, 18% died within one month of birth. In contrast, of the 29 lambs born in the same flock over the next two weeks, after transhumance to the Haoz Plains, none had died by mid-February 1985.

Of course, transhumance between alpine and lower elevation ranges does not assure a perfectly steady supply of forage throughout the year. Due in part to malnutrition, mortality is high in mid-winter for both adult and newborn animals. When range forage is in short supply but animal nutrition needs are high (i.e., in winter), flocks are supplemented from forage produced on the small fields of the Imenane's mixed farms. But households lack adequate forage to supplement their entire flock throughout the winter. As noted earlier, irrigated pastures are exploited by only a relatively small percentage of a household's flock (Table 4.4). Normally, only lactating ewes and does are supplemented, in order to reduce lamb and kid mortality during the first, critical month when newborns subsist solely on milk.

Climatic Uncertainty

Semi-arid climates experience wide fluctuations in yearly rainfall around the average. In the western High Atlas, climatic averages give a false impression of water reliability from year to year. The average annual river flow of the Rherheya watershed as measured at Tahanaout from 1970 to 1983 was 1.5 m^3 per second. But this varied from 0.4 to 2.9 m^3 per second in 1982–1983 and 1970–1971, respectively. Such climatic variation leads to two further uncertainties in range-animal production in the Atlas.

TABLE 4.5 HAY FEEDING OF FLOCKS (WINTER 1984-1985)[a]

HOUSEHOLD[b]	KG HAY HARVESTED	KG HAY FED	PERCENT HAY FED
1	900	300	30
2	300	0	0
4	100	0	0
5	2000	900	50
6	200	80	4

[a]Hay not given to flocks was fed to bovines or equines.
[b]Household 3 produced no hay and is not shown.

One is fluctuations in forage supply from year to year. Local shepherds expect a rich supply of forage following winters of heavy precipitation, and flock starvation following winters of low precipitation. People respond to this uncertainty with a degree of resignation. Imenane stockowners regularly purchase and truck in extra forage for their cows; but they apparently never do so for their small ruminants, even during a drought. Their reasoning is that in a lengthy drought, the flocks will starve to death eventually; so why throw good money after bad by buying hay or straw for starving sheep and goats?

The other climatic risk facing Imenane stockowners is sudden, deep snowfalls. These can trap a flock indoors for several days or leave the animals stranded on the mountain to starve. Coupled with the chronic malnutrition typical in winter plus the stress of severe fluke infestation, sudden starvation can lead to catastrophic losses. One man described how 40 sheep in his flock expired in only a few days in the winter of 1983–1984. Households meet such challenges by diverting some of the winter hay normally fed to cows to the snowbound flocks. Emergency feeding of the whole flock does not last long, however. In 1985, feeding ranged from as little as four days in one flock, to no more than 25 days in two others observed. Although this feed is of critical importance, the amounts given each animal are small: from 0.1 to 0.3 g per head per day, or about 0.4% to 1% of the live body weight of a typical ewe. The percentage of each household's total hay crop fed to flocks during these emergencies varied in the winter of 1984–1985, but it was never more than 50% for any household studied (Table 4.5).

On snowbound days, flocks are also supplemented on nearby irrigated pastures that are usually saved for lactating females. People shovel away the snow from the terrace and herd the entire flock on these pastures. Again, although the amount of irrigated forage appears small when averaged over the entire year, it plays a critical role in keeping the animals alive over the winter.

ECOLOGICALLY ADAPTIVE DEVELOPMENT POSSIBILITIES

Berber agropastoralists of the High Atlas Mountains have adapted to their local ecology in such a way as to overcome environmental constraints to animal production. Ecological adaptability allows flocks to be moderately productive with minimal inputs of cultivated or other supplements. This strategy may not be so productive as modern, intensive flock management practices that seek to control a greater number of environmental factors. But a minimal use of limited inputs coupled with seasonal flexibility in range exploitation may be the only realistic model for pastoral development wherever arable land, water, and capital are severely limited, yet non-arable rangelands are abundant.

Pastoral production in the Imenane Valley can be developed in conformity with this traditional, adaptive strategy. For example, to improve the supply of milk to lambs without feeding ewes an expensive lactation supplement, developers might suggest that shepherds prevent breeding from May to August. The offspring of these summer matings, born from October to January, seldom receive enough milk. Without flushing, ewes would tend to breed from February to April in years of winter transhumance. In other years they would breed in September and October while grazing the reserved late-summer/early-fall range. Lambs from these matings, born from July to September or in February-March, would be more likely to receive adequate milk. In order to improve the winter forage supply, for example, shepherds might defer grazing in spring and summer on ranges near villages. They could use higher, more distant ranges, saving village grazing grounds for the winter, when higher ranges are snowbound. The azimz described earlier is an example of one group's deferring a winter pasture for this purpose.

Both these suggestions obviously pose problems of labor allocation. Under the present system of grazing, summer is a season of labor bottlenecks. The flocks must be herded at the same time that winter barley is harvested and summer crops are planted. Separating rams from ewes to delay breeding or forbidding the use of nearby pastures in summer would strain the pastoral labor supply of many labor-poor households. But within the ecological context of rangestock production, both of the suggested measures would improve the synchronization of animal needs and forage availability at little cost in land, water, or capital.

SUMMARY AND CONCLUSIONS

Agropastoralists in Morocco's Western High Atlas raise small ruminants to exploit the extensive rangelands surrounding their small, mixed farms. Their traditional production system is constrained by seasonally fluctuating forage supplies, by cyclical shifts in flock nutritional needs, and by uncertainty in

forage availability from year to year. Stockowners overcome these constraints by adapting to the local ecology, transhuming with their flocks to avoid stresses and to exploit varying forage opportunities along the 3500 m of vertical ecology in the mountain/plains complex. When the nutritional needs of part of the flock are high but forage availability is low, people supplement some animals from the small, arable land surface. Agricultural complementarity also lessens the occasional risk of flocks' starving while snowbound. But longterm drought is accepted by small ruminant owners; and they let their flocks starve when range forage is in very short supply.

This animal production strategy is minimalist in its use of critical cropping inputs like water and arable land. It relies instead on flexible responses to intra- and inter-annual changes in ecological relationships between livestock and rangelands. We have suggested improvements in this production strategy that are ecologically adaptive and that minimize the use of cultivated forage, although they also imply added labor. More broadly, we have described the specifics of agropastoralism in the High Atlas in order to illustrate more general ecological principles of range-animal production. For development initiatives aimed at enhancing smallholder agropastoral production, these principles and perspectives can be applied equally well in other parts of the world where, as in the Atlas, much wasteland lies outside the arable perimeter.

NOTES

1. This chapter is based on nearly two years' research in Morocco with the USAID Title XII SR-CRSP Grant No. AID/DSAN/VII-G-0049 in collaboration with l'Institut National Agronomique et Vétérinaire Hassan II. Additional support was provided by the University of Missouri-Columbia and Utah State University. The authors wish to thank Mohamed Mahdi for his sociological insights and inputs across many conversations.

2. The study area contains the villages of Tachdirt, Ouanskra (with Talat n'Chaote), Tamguist (with Tineghourine and Azdowkhs), Ikkis, Amsekrou, Arg and Ousertek (including the separate villages of Glis, Agadir, Imsoughene, Tidli and Tineghouar). Rural tax records for 1979 list 284 households in the area.

3. Black-and-white 1:50,000 scale aerial photos, taken around 1965, were enlarged to 1:10,000 and ground-truthed in 1985. A 1:100,000 topographic map of Oukaimeden-Toubkal (Division de la Carte 1972) was planimetered. No corrections were made for slope, so the total watershed area is underestimated. The area of irrigated fields, which are usually more level, is more accurately estimated. Because of the space occupied by retaining walls between terraces, actual cultivated area is much less than the area within the irrigated perimeter. Therefore, we performed several photo transects to estimate the proportion of actually arable terrace land to non-arable terrace walls. Total area within the irrigated perimeter was then multiplied by the resulting correction factor in order to estimate actual cultivated area. Climatic records were made available by SODEA, IRE, CAF, and the Faculty of Science of Marrakech University.

4. One very prosperous household (No. 5 in the tables) and three relatively prosperous ones (1, 2, and 6) were interviewed in Tachdirt and Tineghourine. Two much poorer households (Nos. 3 and 4) were interviewed in Arg and Tidli. The flock movements illustrated in Figures 4.1 and 4.2 are those of household 5. Unlike stockowners in other areas of Morocco, the groups discussed here do not move their flocks by truck.

5. Based on data for Asni (1200 m elevation) from September 1977 to July 1985.

6. Household 4 in Table 4.4, with 100% of its flock on irrigated pasture in December and January, is an apparent exception. But the adult flock consisted of only two female goats, intensively managed for regular, twice-yearly parturitions.

7. Precipitation comes to Marrakech during the relatively warm winter, when native ranges produce succulent forage. The average temperature for July and August is 29° C, but mid-day maxima are of course much higher. Flocks native to the Haoz are said to need barley straw or beet pulp as supplements in late summer, because the desert provides little forage.

8. Given a four-year average (1981–1985) of daily minima in December, January, and February of −2° C but ranging as low as −15° C, Oukaimeden is used as a winter ski resort, with meter-deep snow not uncommon.

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5

THE AGROPASTORAL DIALECTIC AND THE ORGANIZATION OF LABOR IN A QUECHUA COMMUNITY[1]

Constance M. McCorkle

The many advantages to combining agriculture and pastoralism have been well-documented both worldwide and for the Andes (Bayer and Waters-Bayer 1989; McCorkle 1983a; McDowell 1980; Perevolotsky this volume; Vincze 1980; Yamamoto 1981, 1988, among others). They include such interactions as: the cyclical allocation of fields to cropping and herding so that land is in constant production; the use of crop residues and byproducts to feed animals and, conversely, of animal manure to "feed" (i.e., fertilize) crops; the clearing, reseeding/trampling, and plowing services livestock provide in field preparation; animals' transport of agricultural inputs and produce to and from fields and markets; herds' critical role as investment options for storing agricultural surpluses in a highly fungible form that when crops fail, provides ready cash for reinitiating cultivation; and still more.

The same cannot be said for the disadvantages, however. Particularly in the household economies of peasant smallholders, cropping and herding conflict with each other at many points: ecological, technological, and socio-organizational (Vincze 1980). These conflicts are ultimately grounded in the limited productivity of peasants' preindustrial or "paleotechnic" (Wolf 1966) agriculture, i.e., cultivation that utilizes few or no commercial inputs, relies primarily on a non-mechanized tool culture driven by human and animal energy, and hence is highly labor intensive.

Ideally, given peasants' characteristic goal of productive autonomy, perfect agropastoral integration is achieved only when the household can provide for all its cropping and herding needs itself (Vincze 1980). The latter include: sufficient and nutritionally balanced pasture and cultivated fodder to see animals through dry or winter seasons; adequate shelter from the elements and protection from predators and thieves; skilled labor for veterinary care and specialized manage-

ment operations like docking or castrating; and a sufficient and competent workforce for shearing, daily herding, and so forth.

However, this ideal presupposes an intensive agricultural adaptation capable of providing for fodder cultivation, grain feeding, rational pasture rotation systems (usually implying fencing), strong sanitary shelters, and herd divisions by sex, age, and species. Peasants can hardly aspire to this ideal. They typically suffer a shortage of arable land, whether sociopolitically or naturally imposed. Coupled with a paleotechnology, land shortage (and the often concomitant shortening of fallow periods) leads to low agricultural productivity. In addition, conflict arises in allocating scarce land resources to human versus animal needs. Seldom can peasants afford to plant much of their land in fodders[2] or to divert much, if any, grain from human to animal consumption.

Of course, without intensive hay and/or grain feeding, animals cannot be permanently stabled. Instead they must forage for food on open ranges. Range-stock operation introduces further conflicts between cultivation and herding by geographically divorcing the two. Pastures must be sought farther and farther afield as those near croplands become exhausted (Jamtgaard 1984, McCorkle 1987). Moreover, different livestock species often require different forages located in widely dispersed ecozones. In consequence, agricultural and pastoral workplaces become separated, sometimes by considerable distances.

This leads to additional disjunctions, particularly in the deployment of labor.[3] The labor demands of a diversified but paleotechnic adaptation are very high, and require the participation of all available household members. Even so, this workforce is rarely enough to single-handedly cope with the multiplicity of plant and animal crops to be tended. The recruitment, allocation, and synchronization of labor for simultaneous cultivation and stockraising pose perhaps the greatest challenge to peasant agropastoralism worldwide. Tensions between the two sectors of production are especially acute during peak labor crunches in the cropping cycle. Then, animals may have to be pastured far from the village to keep them from invading ripening fields. At the same time, herds may require extra attention beyond the usual daily grazing. For example, the same rains that green the fields also promote many of the parasites that attack livestock.

A further difficulty in the allocation of agropastoral labor is the characteristically small size of peasants' herds. Given the lack of stabling or fencing, someone must be in everyday attendance upon the creatures. Yet a single individual can easily oversee three or more households' herds, and up to a thousand animals depending upon the species (Orlove 1977:85–86). It therefore seems a less-than-optimal utilization of labor to shift one household member from agricultural to pastoral work merely in order to supervise a few dozen animals.

Taken together, these factors jeopardize the integration of the two types of production. All these problems are exacerbated by a generalized procurement strategy (Rhoades and Thompson 1975) in one of the world's most complex

environments—the high-altitude tropical mountains of the Andes. There, peasants must cope with multiple species of plant and animal domesticates, and with extraordinary ecological variation in fields and pastures. Worse still, neolocal nuclear-family households are the norm among Andean agropastoralists. They do not have "in-house" access to the rich labor resources enjoyed by extended and/or polygynous households in many other parts of the developing world, or even to the more generous labor pool that Andean "pure" pastoralists of the region control. The latter typically live in extended-family units and/or durable, cooperating patrifocal groups approaching minor patrilineages (Caro 1985, Custred 1977b, Flores Ochoa 1977, Inamura 1981, Orlove 1977, Palacios Ríos 1977, Webster 1973). Moreover, Andean pastoralists typically inhabit a single altitudinal zone, where they may herd only two closely related animal species (llama and alpaca) and cultivate little more than a few types of tubers.

Neither do many indigenous communities of Andean agropastoralists boast formal herding organizations for aggregating animals and sharing out grazing and other pastoral duties, as in the alp associations of traditional Swiss peasants (Friedl 1974, Netting 1976), the Galician *beceira* or *ronda* (Reiner Bauer pers. com.), the *paliskunta* of Finnish reindeer owners (Ingold 1983), and many more. Nor do they often have recourse to herding specialists, as documented for many African cultivators' symbiotic arrangements with pastoralists, or to symbiotic farmer-herder relationships like those of northern coastal Peru (Perevolotsky this volume).[4]

In short, in mixed peasant economies everywhere, and perhaps especially in the high Andes, plant and animal domesticates are in direct and, at certain times of the year, fierce competition with one another for scarce household labor. Stockowners must therefore take steps to offset this conflict. Drawing upon 11 months' research conducted in 1980 and 1987 in a Quechua Indian community of highland Peru, this chapter illustrates and analyzes the kinds of organizational tensions that peasant agropastoralists face in mobilizing labor for simultaneous cultivation and stockraising. The focus is on the strategies they employ to recruit labor for daily herding. The conclusion suggests implications of these findings for development efforts aimed at increasing either crop or livestock production in such milieu.

AGROPASTORALISM IN USI

The study community, Usi, lies above the Vilcanota River valley in the District of Quiquijana, Province of Quispicanchis, in Peru's Cuzco Department. In 1980, its population consisted of 106 households averaging 5.6 members. The majority residence pattern is one of neolocal nuclear families. The people of Usi are Quechua-speaking Indians whose culture and technology are among the most traditional to be found in highland Peru today. Politically, the village

is organized as an official Peruvian Peasant Community. (For greater ethnographic detail, see McCorkle 1983a or 1987.)

Along with barnyard animals (poultry, swine, guinea pigs) and equines (burros, horses), sheep, llama, alpaca, and cattle are raised. In 1980, 84% of all households kept at least one of these ruminant species.[5] Among the remaining 16%, the majority were either young couples who planned to establish a herd in the future, or households who had recently lost their animals to epidemic disease or sold them off to meet ritual *cargo* obligations. Within the 30% stratified village sample studied, mean (and median) household holdings of ruminants were 26.8 (21) ovines, 5.2 (4) camelids (mostly llama), and 1.3 (0) bovines. For sheep, these figures are strikingly similar to those reported for many other agropastoral communities of highland Peru (e.g., Fernández this volume, Jamtgaard 1984:29, LeBaron et al. 1979:201, West 1981).

While these numbers may seem small by Western standards, their importance for Andean peasants' survival looms large. The animals provide not only cash, wool, hides, leather, fresh and jerked meat, milk, cheese, transport, important ritual paraphernalia (e.g., llama fetuses), and savings and investment opportunities; they also furnish invaluable manure. Animal dung is virtually the sole source of fuel in the high Andes. But more importantly, given the prohibitive cost of chemical fertilizers for many Quechua communities, without this vital animal product cultivation of the staple foodcrop, potatoes, would barely be possible (Augstburger 1983, Jamtgaard 1984, McCorkle et al. 1989, Winterhalder et al. 1974, Yamamoto 1988). Indeed, the availability of manure as fertilizer constitutes one of the classic advantages of integrating cropping and herding (see also Conelly this volume).

The community of Usi occupies a "compressed" (Brush 1977a) type of Andean vertical ecology (Murra 1972). Usi's territory extends from 3200 m at the Vilcanota River valley floor up to 4985 m along the peaks above the village. Within this altitudinal gradient, Usiños exploit three major agrolife zones (Mayer 1979). Each manifests a different constellation of plant and animal domesticates, climate, land tenure, and agricultural regime (Guillet 1981).

The first is the low or maize zone (3200 to 3500 m). The warmest and most fertile ecozone, this area extends upwards along the high-valley cleft (*wayq'u*) from the banks of the Vilcanota. The zone is primarily devoted to irrigated maize fields that ar cropped yearly. But fieldpeas, squashes, wheat, early irrigated potatoes, commercial onions, *ulluku (Ullucus tuberosus)*, *kinwa (Chenopodium quinoa)*, and a few fruit trees are also raised. In parts of this zone, the Spanish plow can be used. Because the land is under near-constant cultivation, little herding is done except for postharvest stubble grazing or pasturing a few head of cattle, since this species thrives best at lower altitudes. Land here is fully privatized, with no communal usufruct at any time (Guillet, this volume).

Second is the intermediate or tuber zone (3500 to 4000 m). The main population settlement is located in this zone, the better to exploit the other two.

Rainfall cultivation with the Andean footplow is the rule here. The rocky ravines, narrow ledges, and steep shoulders of the mountains preclude animal-drawn plows. Potatoes and other tubers are the principal crops, alternating with barley; but broadbeans and Andean chenopods and lupines are also raised. The land is operated under the Andean sectoral fallow system, a communally controlled block rotation of fields (e.g., Orlove and Godoy 1986). The potato/barley sectors are generally cultivated for two years and then fallowed for three years, during which time they serve as communal grazing and gathering grounds. Sheep are the predominant herd animal in this zone.

Third is the high or pasture zone (4000 m and above). Here lie the cold, thin-aired *punas* of the southern Andes. Tough native bunch grasses dominate the landscape. Aside from some limited cultivation of bitter potatoes and barley, this area is given over to communal pasturage yearround. All ruminant species can be grazed here, although at these extreme altitudes cattle reportedly fare poorly while the indigenous camelids flourish. Because of fewer parasites due to the cold and dryness of the punas and the greater pasturage to be found there, sheep are said to produce better here, too.

Clearly, villagers must deal with many kinds of plants, animals, fields, seasons, and even differing agricultural implements and techniques. The number of crops to be tended is nearly doubled since there is both an early and a late or an irrigated and an unirrigated planting for many cultivars. Additionally, all major crops are grown in a gamut of subspecies. Furthermore, the plowing, furrowing, fertilizing, planting, hoeing, harvesting, threshing, preserving, and storing schedule varies for almost every crop. With the exception of limited use of the Spanish plow in the low zone, all these activities are performed with a paleotechnic tool kit. Worse still, the demands of cultivation are relatively inflexible. Land must be plowed while still soft from the rains. Manure must be collected, sacked, and transported long distances on the backs of animals and men, to be on hand in the fields at planting time. Ripening crops must be protected from theft and the depredations of animals. Fields must be harvested before the frosts come. And produce must be processed and properly stored or marketed while seasonal conditions and work loads permit.

In sum, at no month in the year are these or any other Andean agropastoralists free of the heavy manual labor of preindustrial cultivation (see also Brush 1977b). Yet at the same time, under rangestock operation animals require daily droving and supervision—not to mention other, aperiodic chores like shearing, breeding, docking, ear-notching, castrating, curing, and performing the all-important reproductive and protective rites (*t'inka*) for each ruminant species. Multiple-species management of rangestock across different agrolife zones further intensifies the already heavy pastoral production schedule. Figure 5.1 graphically illustrates Usi's complex annual cycle of agropastoral tasks. Even a quick visual inspection of this figure should suggest some of the acute territorial, seasonal, and managerial tensions confronting Andean agropastoralists in their

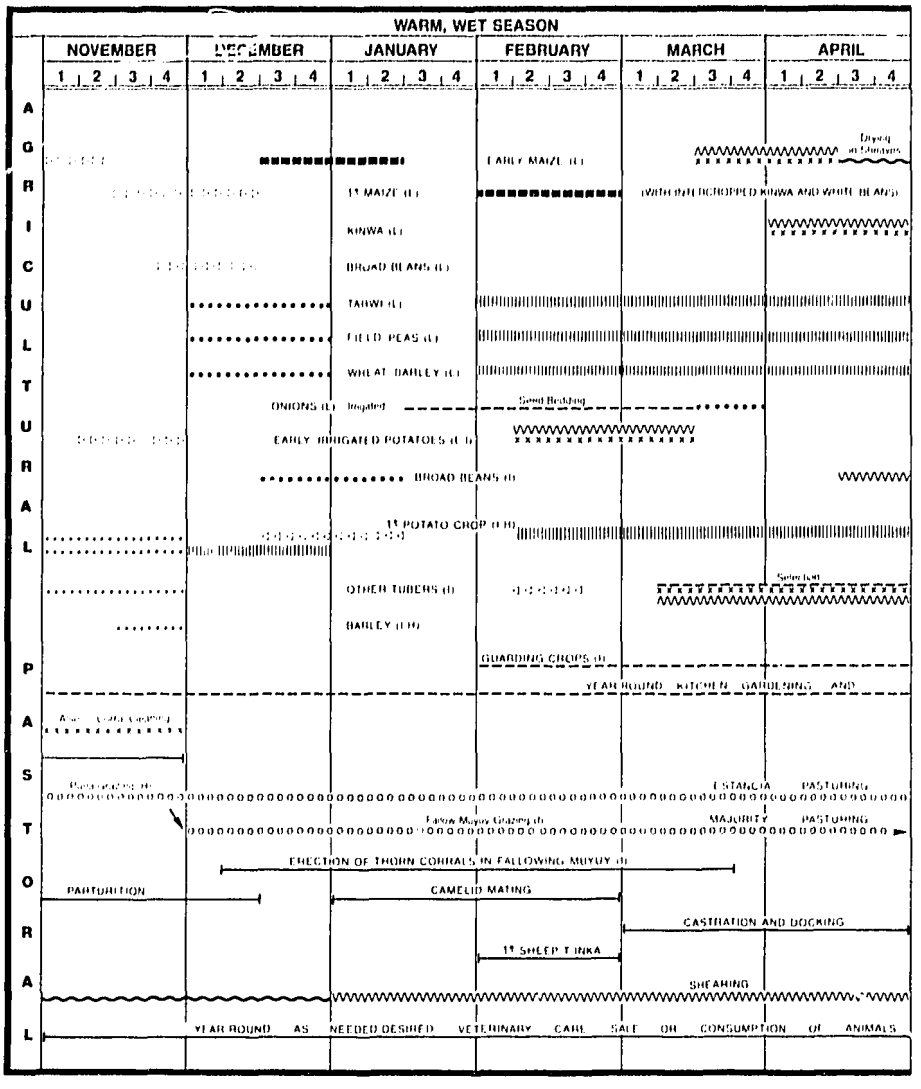
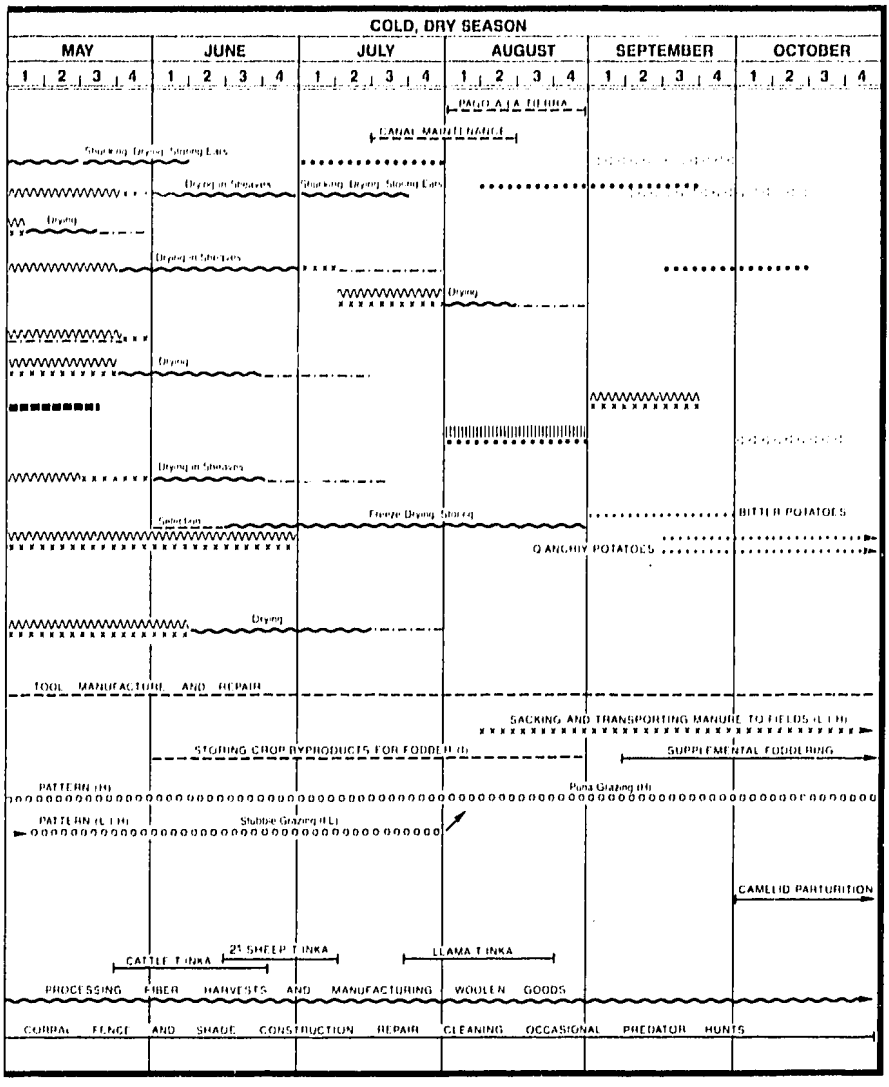


FIGURE 5.1 THE ANNUAL CYCLE OF MAJOR

KEY

- PLOWING FOR NEXT YEAR'S CROP
- PLANTING
- FIRST AND SECOND HOEING
- WEEDING
- HARVESTING
- TRANSPORTING
- PROCESSING (DRYING, STORING, OTHER)
- THRESHING, WINNOWING, AND STORING



AGRICULTURAL AND PASTORAL TASKS IN USI

ooooo PASTURING
_____ ANIMAL MANAGEMENT TASKS
_ _ _ _ OTHER TASKS (SEE FIGURE)

L IN LOW AGROLIFE ZONE
I IN INTERMEDIATE AGROLIFE ZONE
H IN HIGH AGROLIFE ZONE

allocation of scarce household labor to cropping versus herding. How, then, do they obtain and organize the labor to range their herds and herd subdivisions across time and space, while simultaneously pursuing paleotechnic agriculture?

LABOR ORGANIZATION STRATEGIES IN USI

Usiños' answer to this question is, through smallscale herding associations. In Usi, these rarely reach a cooperative level greater than three households. These associations may be kin-, fictive-kin (i.e., *compadrazgo*), or non-kin-based. They comprise household-external but almost exclusively community-internal relationships involving an assortment of labor exchange, procurement, and specialization devices. A single household often must have recourse to several such arrangements to meet its multiple-species herding needs.

Both husbands and wives can initiate pastoral associations. However, in Usi as in most Andean agropastoral communities, women have primary responsibility for livestock care in the majority of households; along with adolescents and children, women normally see to the daily herding (Deere 1983, Fernández this volume, McCorkle 1982b, Merlino et al. 1988). But once a pastoral association is initiated, any capable member of the household can be called upon to help meet its labor obligations, including men.

The avowedly preferred form of extrahousehold pastoral labor recruitment in Usi is what Andean ethnologists variously term cooperative, reciprocal, or exchange labor (Alberti and Mayer 1974, Lehman 1982). In these arrangements, labor is traded for labor. For many reasons, in little-monetized and heavily subsistence-oriented communities of the Andes, this is the most rational (as well as traditional) mode of interhousehold cooperation, with more efficient cost-benefit ratios than hiring wage labor (Brown 1987; Custred 1977a; Guillet 1980, 1981). Only rarely will Usiños resort to contractual labor. Although technically defined as exchange of labor for the equivalent in cash or kind, in reality cash never directly figures in such transactions among Usiños. Instead, payments are made in varying combinations of meals, livestock, local farm products, and other goods.

Reciprocal and, with frequent exchanges between the same partners, contractual labor also entail diffuse social costs, e.g.: attending and making material contributions to the ceremonial celebrations of one's herding partners; trading small gifts and friendly advice; assisting in minor agricultural, culinary, gathering, marketing, child care, and other chores; lending tools or foodstuffs; and so forth. These social costs are in part related to another feature of all these relationships—their "unofficial" nature. Such associations are ". . . informal, or implicit, since they lack ritual or legal basis. They are not based on any idea of law, and they are unenforceable through authority; they exist only at the pleasure of the contractants" (Foster 1961:1174). Ancillary social exchanges reinforce these unenforceable relationsips. Of course, mutually agreeable terms of ex-

change, a high degree of trust, and confidence in herding partners' pastoral competence are all necessary to the establishment and stability of such associations. If one household often proves uncooperative or falls behind in its obligations, or if herders become lax or dishonest in their task, the relationship will be terminated.

The following overview of Usiños' pastoral associations is broadly organized in keeping with villagers' own preference for reciprocal over contractual labor. Hence the most common strategies are described first. This approach also produces a rough sequence of exchanges moving from generalized to balanced, and from informal to more formal. Whenever possible, each association is labeled with the term (whether Spanish or Quechua) most often employed among Usiños themselves. Where no such term was recorded, I coin my own. Case studies and transactional specifics of each associational type are available in McCorkle 1982b or 1983a.

Yanapanakuy

In its pastoral context, *yanapanakuy* 'helping' can be loosely glossed as "joint herding." This simple strategy is almost universal in Usi. It merely consists of groups of herders grazing their animals together on the same day in the same locale, either by happenstance or design. The benefits of joint herding are both social and economic. Women may while away part of the long grazing day in conversation, reinforcing ties of kin- and friendship. Adolescents may do the same, while sharing songs and flute music or teasing and flirting with the opposite sex. Child herders enjoy games and general play. The economic advantage is that companions can keep an eye on each others' animals while taking turns at supplemental gathering activities like collecting firewood or dung for the cookstove, grasses and leaves for guinea-pig feed, straw for thatch and kindling, and magical, medicinal, and culinary herbs. Joint herding thereby frees part of the pastoral workday for other economic activities.

This strategy has other benefits, too. It is especially useful for households in the early stages of the domestic life cycle, who must sometimes send a five-or six-year-old child out to herd. In such cases, parents usually arrange for the child to accompany a known and trusted older person who is also herding that day. (Similar arrangements are made for sending young children to market.) No fees or standardized exchanges are incurred in any instance of yanapanakuy.

T'inkikuy

Although a precise translation is impossible, *t'inkikuy* connotes "offering aid." The word denotes a reciprocal exchange of labor specifically for daily supervision of herds. It is more or less the pastoral equivalent of Andean agriculture's *ayni*. In fact, villagers sometimes also term it *ayninakuy*. For Usi, ayni can be broadly defined as work performed in return for (usually) the same

service between households, figured on a per-day, per-person basis, and kept in fairly strict accounts.[6]

In t'inkikuy, two or more households pool their herds for daily grazing. A member of one of the cooperating households merely collects the others' animals in the morning, drives the aggregated herds out to pasture, watches over them together, and returns them to their home corrals at the end of the day. This association is most often used for sheep. T'inkikuy partners may or may not be related by real or fictive kinship, but they almost always reside in the same neighborhood, so as to facilitate the morning pooling and evening separation of flocks.

The understanding among the cooperating households is that caretaker services are always "on tap." But for aperiodic occasions, prior plans convenient to all concerned must be made. When the need for herding help is regular and predictable, however, a longstanding schedule of labor exchange may be instituted. Payment is always rendered in return service, not in cash or goods. But when the shepherd/ess is a non-adult, the household receiving the service must supply her/him with the customary *cocabí*, a cold lunch, for the day.

T'inkikuy is by far the most prevalent pastoral association in Usi. Nearly every stockowning household practices it at one time or another in the course of a year—for example, during the harvesttime labor crunch, when entire families sleep out in the fields to protect and gather their crops; or during the academic year when child labor for herding is at a premium. Without this socio-organizational resource few Usiños would be able to raise herd animals at all.

Species Specialization

In this association, two households possessing small numbers of different-species animals merge their same-species herds and divide the responsibility for their care. For example, the cattle of one household are quartered and supervised by another cattle-owning family, while the latter's sheep join the flock of the former. This arrangement is typically kin-based and longterm, and involves no formal payments.

Species specialization is a particularly apt labor-saving device in that it simultaneously aggregates animals and provides for important herd divisions that make for better livestock management. It offers several benefits. First, if the two households did not cooperate in this fashion, then twice as many herders ideally would be required in order to exploit the forages best suited to each species across dispersed agrolife zones. Second, only half as many corrals are required. Villagers note that, for a number of health and safety reasons, large and small ruminants should not be quartered together. But sturdy stone or adobe corrals are in somewhat short supply in Usi. Third, this strategy allows for some specialization of pastoral knowledge. Herders who deal daily with only one species have greater opportunity to make detailed empirical observations of its

forage preferences, ethology, disease susceptibilities and symptoms, etc. and can therefore give it better care.

This is an especially important consideration for cattle-owners. Less than 50% of Usiño households possess cattle. Consequently, relatively few people have extensive knowledge of bovine needs and habits. Moreover, relative to camelids or even the alien ovine, cattle are poorly adapted to the harsh conditions of the high Andes. They are less sure-footed on the rocky slopes and excruciatingly narrow paths. With their larger body mass, the altitude affects them more. As non-wool-bearing creatures, they suffer more from the cold and wet. And their size and appetite requires the best available forages plus dietary supplementation, especially if they are to serve as draught or milch animals. Yet cattle are the costliest of all herd animals in the Andes. (One head of cattle is worth roughly ten times the value of a sheep and six times that of a camelid.) Specialization of labor in and separation of bovines helps peasants protect this major but risky investment.

Boarding

Boarding constitutes an alternative organizational strategy for households who are short on labor but who own two or more species of herd animals that ideally require different but dispersed forages. Boarding consists of placing animals at a co-villager's 'ranch' (Spanish *estancia* or Quechua *astaña)* in the punas of the high zone. These ranches consist of little more than a rough stone or adobe hut and some corrals. The punas are *ayllu* lands, i.e., they are under communal control with indivisible use rights (Guillet 1981, this volume). Thus any Usiño is free to establish a ranch in the punas. All that is required is the labor to build and staff it. In this respect, however, it is significant that most couples who maintain an estancia are blessed with an exceptional number of children (4 to 6) of herding age and/or they live in an at least temporarily extended household.

Longterm boarding typically involves llama or alpaca. Shortterm arrangements may also be made to board ailing or temporarily sterile camelids so they can exploit the more plentiful forages and reputedly more salubrious climate of the punas. As the cropping season progresses, sheep and cattle may also be temporarily quartered at the estancia of a kinsperson or friend. Boarding is a contractual association entailing fairly standardized fees. According to all informants, one *q'ipirina* (a carrying cloth about 1 m^2) *of avio* (local produce and other supplies like kerosene, salt, sugar, and noodles) must be delivered roughly once monthly to the ranch personnel. Members of households receiving longterm boarding services are also expected to take an occasional turn herding at the ranch and repairing its corrals.

Both partners in this arrangement benefit. Even well-to-do estancia owners appreciate the input of goods and labor from boarders, for it significantly defrays

the material and human costs of maintaining a second residence in the distant (and sometimes dangerous) punas. And non-ranch-owners who lack the labor to range divided herds across different agrolife zones can thereby invest in greater numbers of different species. Also, by affording sick or unthrifty camelids the improved nutrition of puna forages, people can better protect their investment in these more costly species. Finally, boarding sheep and cattle out as harvesttime approaches serves both to keep animals away from the ripening crops (thereby also avoiding disputes among co-villagers) and to free up more labor for the hectic work ahead.

Recruitment of Child Labor for Herding

Under this rubric are grouped three organizational strategies that, although differing in structure and payments, are related insofar as all concern the recruitment of extrahousehold child labor. Quite simply, a labor-poor household solicits the use of a surplus girl or boy from another household to help out with daily herding. Such arrangements serve to equalize the distribution of a valuable human resource across the community. As Thomas (1973) argues, children are the preferred source of pastoral labor in the Andes because they are energetically more efficient than adults. He calculates that the total energy cost of daily herding by an adult is 30% more than for a 12-year-old of the same sex. The deployment of household children as herders thus reduces hypocaloric stress on the unit as a whole. Given the meals that figure in the fee structure of the associations described below, the same is true for households with more than the average number of mouths to feed who "hire out" their surplus children as herders. That is, all parties in these exchanges benefit calorically as well as pastorally.

Michichikuy. In this association, a child herder is hired on a brief and aperiodic basis. Usually non-kin are involved. The child's parents typically receive a fee of one *unkuña* (a cloth about 0.5 m^2 that accommodates about 3 kg) of local foodstuffs for every two to three days that she/he herds. Additionally, the child receives a daily lunch. Adolescent girls may also earn several handfuls of wool for each day they herd.

This strategy appears to be a "last ditch" method of acquiring pastoral labor in emergencies. As noted earlier, reciprocal is usually preferred to contractual labor. This is especially true where ovines, as versus the far more valuable camelids or bovines, are concerned. However, stockowners may have recourse to this association when their normal network of kin, friends, and t'inkikuy partners temporarily fails them; when they are so labor-poor they cannot return t'inkikuy; or when they are unwilling to assume the increased social costs of initiating new reciprocal obligations. Hiring a shortterm child-herder may offer the most attractive solution to irregular, temporary labor shortages, given the relatively small material outlays entailed.

Longterm Recruitment of Child Labor. This strategy ensures a stable supply of pastoral labor when shortages are apt to last for several years, e.g., at the beginning or end of the domestic life cycle. In this arrangement, the herds of two households are daily pooled, to be overseen by the child of one. Despite the fact that all documented instances of this association involved consanguineal links between women and the shepherdesses they contracted, formalized annual payments of stipulated items of clothing for the child are required in addition to the usual lunches. Also, it is informally understood that the client household will occasionally aid the shepherdess' parents in various tasks and ceremonial costs.

This form of longterm recruitment is most common among young couples who, although they already have one child herder of their own, wish to reap the benefits of species specialization by recruiting a second child to oversee other species until the couple can reproduce the necessary labor within the household itself. This herding association may also be used to release skilled labor for other pursuits. An example is a village woman who takes in weaving on commission from other community members in exchange for wool and foodstuffs; she also sells her wares on the market for cash. Apparently the weaver earns enough from her craft to justify hiring a trusted shepherdess to replace her in herding.

Wardship. Wardship differs from all the other organizational strategies detailed here in that it responds to pastoral labor shortages not by aggregating animals but by more or less permanently shifting labor from one household to another. That is, a child takes up residence with another household, usually an elderly relative's. (However, parents retain ultimate authority over the child.) This association supplies labor for a host of chores other than just daily herding: fetching water from distant springs, processing and preparing food, carding and spinning, delivering messages, washing clothes, gathering fuel, feeding barnyard animals, and so on. Wardship is therefore an especially apt and common form of labor recruitment for elderly or infirm couples who require more help in more varied activities than do other labor-poor households.

No formal payments are stipulated in this arrangement, but it is understood that guardians will provide all the child's basic needs, like room, board, clothing, and medical expenses. Moreover, there is evidence that lines of inheritance play a role in this association. When "child givers" are unlikely to inherit from "child takers," the more formalized and balanced reciprocity of longterm child-hire typically obtains. But if inheritance is a real possibility, wardship may result instead. Indeed, it appears that child givers are willing to surrender essentially all the child's labor in wardship only if they estimate that the child takers will substantially recompense them and/or the child through future endowments, such as an extra share of the funeral herd or of land upon the death of the elderly relatives.

Absentee Caretaking

When stockowners are absent from the village for an extended period (e.g., visiting distant relatives or doing temporary wage labor in other parts of Peru), their animals may be left in the care of a kinsperson, or possibly a friend. Absentee caretaking is typically reimbursed in livestock. The precise numbers, age, and species of animals to be paid vary according to a complicated formula involving a number of factors: the social distance between caretaker and client, the length of the client's absence, the size and composition of the herd being cared for, and the "heart" or good will of the animals' owner.

Longterm caretaker associations are important because they free people to earn much-needed cash in the national sector without foregoing the income or the many social, agricultural, investment, and other benefits of livestock ownership. Both household and community economies benefit. While cash is rarely used within the village, it is required for market purchases of basic household necessities that are available only in the money economy; and the community requires cash for hosting visiting dignitaries, funding civic works like improved waterworks, and confronting Peruvian legal and juridical institutions.

Dar en Partir

Literally 'to give in sharing', this association parallels the traditional Spanish institution of herding *a medias* or *a mitades* 'by halves'. It is a highly balanced, formal, and longterm arrangement common throughout the Andes and many other parts of the world (Bilinsky and Gaylord this volume, Perevolotsky this volume). In this arrangement, one individual gives her/his animals into another's care with the agreement that each will share equally in the herd's growth over time. In Usi, *dar en partir* almost invariably involves cattle. It provides caretakers an excellent opportunity to add to their holdings of the most valuable herd animal without any outlays in cash or kind. In exchange, the client gains the same advantages as those described above for species specialization.

SUMMARY AND ANALYSIS

As Rhoades and Thompson (1975:539) have observed for the Himalayas, in the Andes, too, "Given the present level of . . . technology, there exists no single zone even potentially capable of supporting the entire population for any length of time." Usiños respond to this problem by endeavoring to produce a complex mix of crops and animals in each of their agrolife zones. For the autarchical peasant household, however, this engenders serious disjunctions in the organization of labor for agropastoral production. An especially thorny problem is securing daily labor for overseeing small but multiple-species herds across dispersed locales. Usiños mitigate this disintegrative threat with a variety of

smallscale interhousehold herding associations. Given the norm of neolocal nuclear-family households in Usi, without such strategies only the largest and most labor-rich households would otherwise be able to pursue pastoralism at all.

As we have seen, Usiño herding associations vary in their duration and periodicity, depending on such factors as whether participants' needs are expected to be regular or irregular, shortterm or longterm, and whether they are in a position to return reciprocal labor. People select among and initiate and terminate arrangements accordingly. An important consideration in this process is a household's stage in the domestic life cycle. Other considerations in choosing herding associations and partners may include the species involved; the physical and sociostructural distance between participants; relatedly, the social and material costs entailed by the association; opportunities for alternative activities like crafting or migrant wage labor; and lines of inheritance.

These associations offer many and varied benefits both in pastoralism per se and in other economic and social realms. Above all, pooling herds frees more labor for agriculture. But herd aggregation also facilitates the specialized care and feeding of different species. Relatedly, certain associations ease multiple-species pressure on household corral resources. Others redistribute precious child labor for herding, plus children's subsistence costs, across households. Still others furnish the elderly and infirm much-needed general help and companionship while affording these and other labor-poor households (e.g., young marrieds) access to daily herding services. Moreover, certain arrangements free household members to earn cash in the regional or national economy without prejudicing their livestock investments, while others permit households to increase or diversify their pastoral portfolios by earning animals.[7]

Added to the foregoing benefits is one further, overarching advantage to Usi's smallscale associations: their intrinsic flexibility. Andean agropastoralists' labor requirements and resources typically vary markedly across the years due to the region's periodic droughts and recurrent epidemics of livestock disease, normal shifts in household composition across the domestic life cycle, and the natural increase and decrease of herds. Labor demands can also vary across a few months or weeks thanks to: the fluctuating demands of multi-crop agriculture in a tropical vertical ecology; the diverse breeding, health, forage, etc. needs of different species, or even individual animals, at different altitudes and times of the year; family crises or major ceremonial obligations; emigration or other travel; loss of child labor when school is in session; and still other cyclical or aperiodic events. By initiating and terminating relationships as necessary, stock-owners avoid the mounting material and social costs of more formal, permanent arrangements. This flexibility and relative informality allow Andean agropastoralists to respond rapidly and rationally to their highly changeable physical and human ecology.

IMPLICATIONS FOR DEVELOPMENT

The socio-organizational strategies described above give testimony to the dialectical nature of paleotechnic agropastoralism. Because cropping and herding stand in an at-once complementary and competing relationship in mixed peasant farming systems, development projects aimed at enhancing either of the two types of production can ignore the other only at the risk of "robbing Peter to pay Paul." Put another way, to the extent that basic resources like land and labor are diverted from one sector of production in order to develop the other, peasant subsistence will be imperiled. The margin for error and experiment in such farming systems is small; many people live at the very edge of survival. Development programs calling for significant inputs of additional labor from the already harried peasant household are therefore unlikely to meet with much success unless there are appropriate accompanying changes in the social organization of production.

The Andean data presented here can be used to illustrate the kinds of strains that can ensue. Suppose a project seeks to institute improved husbandry techniques like quarantine of diseased animals, herd subdivisions by age as well as species, or explicit systems of pasture rotation (none of which are practiced in Usi). Under rangestock operation in a paleotechnic adaptation, however, these familiar management methods, so characteristic of intensive stockraising systems, will likely run squarely into the problem of acute household labor shortages for such pastoral niceties.

The solution lies in the organization of labor itself. Although the smallscale associations described here do lighten the load of pastoral labor on the production unit, they hardly approach the integrative ideal of minimizing the conflicts between preindustrial cropping and herding while maximizing their complementarities. *Ceteris paribus*, this "minimax" ideal is better achieved through largescale organizations that aggregate many households' animals and thereby release greater amounts of labor from daily herding. To promote such associations, development programs should take their cue from indigenous social organization. For example, in isolating diseased animals or dividing herds by sex, age, species, function, etc., herd subunits could be aggregated across many households and the labor for overseeing them portioned out in yanapanakuy or t'inkikuy fashion. Likewise, transfer of both the metaphor and the reality of such strategies from the household to the moiety or community level could facilitate both communication about and the introduction of pasture rotation systems.[8]

A dialectical and socio-structurally sensitive approach tackles development within the context of the agropastoral system and community as a whole. With this approach conflicts between agricultural and pastoral production can be defused, and gains in one can be made to redound to the benefit of the other. For example, increased organization of pastoral labor should free up a "bonus" of labor for agriculture. And utilization of indigenous socioeconomic structures

will naturally cause less disruption of community and household lifeways and livelihoods than introduction of alien organizational models.

The lessons to be learned from this case are simple. First, the means for attaining project goals must be carefully assessed vis-à-vis both the integrative and disintegrative aspects of peasant agropastoralism. Second, development projects should work *with*, rather than against, the indigenous production system. Of course, this is possible only to the extent that systemic features—ecological, technological, and socio-organizational—have been empirically verified for the target community and their place and functioning within a people's complex agropastoral adaptation fully comprehended. Otherwise, life-threatening imbalances may be engendered in the plant/animal/people polynomial.

NOTES

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2. In Chapter 7, Guillet presents an apparent exception, but it is closely linked to the presence of extensive irrigation—an intensive cropping strategy that makes investment in cultivated feeds much less risky. Also see the chapter by Mendes and Narjisse.

3. Elsewhere I have discussed the implications of such tensions for choice of grazing strategy, veterinary practices, and other technoenvironmental issues (McCorkle 1982a, 1983b, 1987).

4. The absence of such largescale associations and/or of hired herders in many Quechua communities is "fodder" for yet another chapter on the social organization of Andean agropastoralism, and is not addressed here.

5. If just one species is raised, it is almost invariably sheep. Interestingly, goats have been added to this list since 1980.

6. Between parents and their adult children, strict accounts are not always kept. Also, note that this definition of ayni is specific to Usi. There exist almost as many definitions of ayni and caveats thereto as there are Andean communities. For examples of these variations, the reader can consult virtually any of the Andean entries in the references listed below.

7. However, there is a dialectical disadvantage to some of these associations. Those in which crops slated for human subsistence must be paid out to support pastoralism (e.g. boarding, hiring child herders) in fact exacerbate tensions between the two sectors of production. In contrast, associations in which animals are exchanged for animal care (e.g. absentee caretaking and dar en partir) create no such competition.

8. Of course, in the Usiño case described here, other issues would remain to be dealt with. For example, juridical mechanisms that effectively and fairly control incompetent

or dishonest overseers would have to be instituted (McCorkle 1982b, 1983a). And the flexibility characterizing present pastoral labor strategies would need to be built into any larger-scale associations.

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6

THE SOCIAL ORGANIZATION OF PRODUCTION IN COMMUNITY-BASED AGROPASTORALISM IN THE ANDES[1]

María E. Fernández

Smallscale community-based farming systems are geared primarily to self-sufficiency, at least insofar as food is concerned. Production over and above the needs of household consumption and social exchange is marketed to obtain basic goods, services, and farm inputs. The Andean community-based farm unit controls land through usufruct rights, inheritance, sharecropping, rental, or any combination of these. Production activities are carried out with tools and animals that belong to the household or are borrowed from other households through reciprocal agreements (Williams 1982:382). Access to capital depends not only on the farm unit's productive capacity, but also on market conditions that provide terms of trade favorable enough to permit the unit's acquisition of necessary inputs. In most cases, however, these resources are strictly limited by ecological, political, and economic conditions over which the household has little control (Shanin 1982:238).

Smallscale production systems tend to be labor intensive. Workers must be on hand throughout the year, but especially at labor peaks in the production cycle. In such systems this factor is critical, since all farms are subject to similar labor demands during the same periods; yet neither wage labor nor the cash with which to pay for it is readily available. Indeed, the organization of available labor to meet cyclical production demands is a major challenge to the smallscale system (McCorkle this volume, Perevolotsky this volume).

Over time, high-altitude farming communities of the Andes have designed socio-organizational strategies for managing their natural resources and their agropastoral production vis-à-vis their ecological and economic constraints. One strategy is communal management of natural resources to ensure equitable

access by all households. Another is the optimization of labor through inter-household labor exchanges. A third is the maximization of technological knowledge and skills by distributing decision-making and task performance among gender and age groups (Fernández 1988). These organizational strategies involve people in communal, interhousehold, and specialized management and cooperative task arrangements.

The interaction between community resource management and farm unit production management makes community-based agropastoral systems qualitatively different from mixed, independent household farms, who exercise almost total individual control over their natural and productive resources. A different conceptual and methodological framework is therefore necessary to comprehend the complex interactions of community-based systems. This chapter outlines one such framework, drawing upon SR-CRSP research between 1983 and 1988 in highland *comunidades campesinas* (legally recognized 'peasant communities') of the Aramachay area, Department of Junín, Peru. Although the data presented here are site-specific, 68% of all such communities in Peru have similar ecological and production characteristics (Jamtgaard 1989).

ARAMACHAY AGROPASTORALISM

The nine comunidades campesinas of the Aramachay area are located at altitudes between 3500 m and 4000 m on the western slopes of Peru's Mantaro Valley. The communities average 65 member-households each, with a range of 38 to 120; the average household size is six. In all the communities, grazing grounds and croplands are highly diverse, with soils that vary from fair to poor in quality. The recuperation of soil micro-organisms depleted by cultivation is slow, requiring fallow periods of two to seven years (Mayer 1981:41). Climatic conditions such as limited water availability, irregular precipitation, and frequent frosts and hail make farming a high-risk endeavor. Agropastoral production is carried out by the farm unit. The unit may consist of a single household or of two to five cooperating, related households. This unit is its own primary source of labor; hired labor is uncommon. Cropping and stockraising activities are shared by all members of the unit, depending on the requirements of the two sectors. Farm units typically control 1 to 6 ha of arable land for cropping, with a fourth to a half of this in fallow at any given time. Dryland farming is the norm. In only one of the nine communities do a few farms (less than 5%) have minuscule plots of irrigated land, where fodder is grown. The other eight have only enough water for human and animal consumption.

Each farm unit raises roughly a dozen different crops on an average of 28 dispersed plots ranging from an eighth to a fourth of a hectare each, with different soil characteristics and slope gradients. The principal crops include tubers (potatoes, *mashua*, *oca*, *olluco*), grains (barley, wheat, oats, *quinua*), and in a few cases maize. Species and varieties are frequently intercropped (Salva-

tierra 1985:3). They are selected for their adaptability to climatic conditions as well as for their multiple uses in human and animal nutrition. Most production is destined for on-farm consumption and for meeting obligations to kin residing in the community or in regional or national urban centers. Potatoes constitute the main cash crop, although some barley is also marketed. Barley chaff and other grain byproducts are stored as animal fodder for the dry season.

Livestock species are likewise selected for multiple uses. Sheep are the most important, followed by cattle, donkeys, swine, and guinea pigs. With the exception of the guinea pig, nearly all animals are of *criollo* breeds, adapted during and just after the Spanish conquest. Herds average about 25 sheep, two head of cattle, one donkey, and three swine. Oxen and donkeys are used for farm traction. Both sheep and cattle furnish manure for fuel and fertilizer. Sheep provide wool for clothing and bedding, and are sold sporadically, either on the hoof or slaughtered, when cash is needed. Guinea pigs are raised primarily for consumption during festivals and for ethnomedical uses.

The agricultural and pastoral sectors are closely interrelated and interdependent. In the harsh high-altitude ecology of the Andes, production depends on a rational and efficient use of all natural resources. Mantaro Valley communities devote about half of their exploitable territory to cropping and about half to grazing, thus ensuring a resource base for both plant and animal production (Fernández et al. 1986:24). Herds graze communal rangelands and crop stubbles as well as fallow plots. Crop residues and natural pastures account for the total sheep diet. Barley and oats are used to supplement the diet of cattle, as well as for household consumption. Manure from the household herd is employed as fertilizer. It is accumulated in corrals and then applied to fields at planting time. It is also added to croplands as animals graze fallow fields and stubbles throughout the year. In areas like Aramachay, where vegetation is scarce and agrochemical inputs are expensive, manure is the main source of fertilizer.

This mixed farming regime promotes the maximal use of natural resources. Furthermore, crop diversification and multi-species stockraising reduce and redistribute risks. However, of equal importance to these technoenvironmental strategies are the socio-organizational strategies that community-based agropastoralists of Aramachay employ to manage their complex and uncertain production environment.

THE ORGANIZATION OF PRODUCTION IN ARAMACHAY

Community Management of Natural Resources

Multiple plant and animal species, the small size of agricultural plots, and multi-household use of rangelands make production efficiency a matter of community management. Due to ecological constraints and the limited scale of production, independent farm unit decisions as to natural resource use in certain

realms could bring about rapid resource depletion, both as a result of conflicting interests and dissimilar management practices. For these reasons, from pre-Colombian times forward, Andean communities have developed systems of communal resource management that guarantee each household fairly equitable access to the farm plots, pastures, water, and fuel required for successful agropastoralism.

These systems are overseen by the community assembly, which is composed of one voting representative from each member-household (the father or, in his absence, the mother) and run by an elected council. To determine how a resource should be used, by whom, and when, the community assembly names a committee to conduct a study. The committee's findings are presented to the assembly for general discussion, and the most beneficial action is agreed upon. A second committee is then named to implement the decision and oversee the procedures. When an action requires labor, all households are expected to participate in communal workparties or *faenas*, with each contributing an agreed-upon number of workdays. Households who do not respect the assembly's decisions are sanctioned.

The assembly carries out activities relating to natural and other resources that benefit all member-households, such as planning sectoral fallow systems, allocating controlled communal grazing plots for oxen, and raising communal herds and crops. The following examples are illustrative. In 1988 the community of Miraflores reallocated community land after a 15-year hiatus. Croplands were reassigned to take into account young households with no access to farm plots, thereby restoring an equitable balance of the principal resource for cultivation. As late as 1976 the community of Llacuaripampa still designated which crops could be planted by farm units in each of four cropping zones within its territory, in such a way as to control insect and pest infestation. One community, Cruz Pampa, manages its scarce water resources by permitting member-households to obtain water only during a two-hour period daily. Another Aramachay community assigns each household two trees per year to be cut for fuel so as to forestall wanton exploitation of forestry resources.

The assemblies of all nine communities in the area limit the number of animals that each household may graze on communal rangelands, thus warding against the depletion of forage resources and subsequent erosion. All Aramachay communities also maintain centrally located, communal grazing areas to provide oxen with additional fodder during planting and harvesting, when the animals' workload is greatest and they have less time and strength to reach more distant pastures. In addition, several communities maintain communal herds and/or agricultural plots to raise funds for the community treasury.

In sum, the assembly manages natural resources so that each household can access the soil qualities, grazing lands, and water to produce the variety of plants and animals necessary for self-sufficiency (Mayer 1981:62).

Labor Exchange Among Farm Units

Although the community assembly sets the basic management criteria and distributes resources among its member households, the farm unit is responsible for organizing the workforce for its own production activities. The community-based smallscale farm largely relies upon its own labor. However, at peak labor times it resorts to interhousehold reciprocal exchanges. In the cropping sector, for example, four to six men of different families may form a group to work together on a rotating basis in each others' fields during plowing, harvesting, and threshing. In the livestock sector, women herd other household's flocks on stipulated days each week or when emergencies or cropping, marketing, and other tasks arise. These arrangements help overcome farm labor shortages (McCorkle this volume). For example, they allow women to free themselves from herding when products must be taken to market; and men can rely on exchange labor when large quantities of grain must be threshed quickly to avoid damage from rain.

Interhousehold labor exchange groups may be composed of relatives, fictive kin, or neighbors (Collins 1986:660). Termed *ullay* in the Aramachay area, these exchanges tend to be longterm, stable arrangements, although shortterm exchanges for specific tasks such as house-raising are also common. The men or women who work together in a labor exchange group tend to share similar technological experience and production objectives. However, these groups do not operate under a hierarchical system. Rather, each member implements her/his own technology, replicating technical and organizational practices in the farms or herds of all involved. There is no supervisor, and the choice of technical practices is a matter of group consensus.

Gender-Related Decisionmaking and Task Distribution

Agropastoral farming in highly variable ecologies calls for vast bodies of biological and technical knowledge both for planning and implementing production. The complexity of mixed farming systems in the Andes has led to a division of production responsibilities among the adult members of the farm unit such that men have greater responsibility for the agricultural sector, and women for the pastoral (Deere 1983). Decisionmaking and technical specialization are closely related. Among Andean agropastoralists, women usually have more expert knowledge of animal husbandry, especially livestock reproductive capacity, health, and nutrition. Hence they can offer the production unit more precise technical information in this sector; for example, when and which animals should be purchased or culled so as to best serve the unit's needs. Conversely, men tend to specialize in cropping. They therefore have greater knowledge of soil quality and rotation patterns in varying plots and can offer better information on cultivation potentials when seasonal cropping plans are being considered. This kind of specialized, technical knowledge gives the "sector

managers" the right to participate actively in their farm unit's larger decision-making processes (Fernández 1988).

A distinction must be drawn here between decisions that span *both* the crop and the livestock sector and affect planning for the farm unit as a whole, versus daily management decisions within sectors. In the former, all adult members are involved, regardless of gender. For example, decisions concerning longterm objectives such as educating children, building a house, or acquiring equipment must be discussed by all adult members of the farm unit. This longrange planning must take into account not only the specialized technological knowledge of the unit's sector managers but also its aggregate supply of land, capital, and labor. To illustrate, if the purchase of an ox is proposed, the crop-sector manager must demonstrate the need for this agricultural input, while the livestock-sector manager must evaluate the availability of forage and supplements with which to feed the animal. Yet together *both* must decide on the source of cash with which to make the purchase, e.g., the sale of potatoes or of sheep. In contrast, management decisions within sectors need not always be discussed. For example, the unit's crop manager may unilaterally determine when to weed and what types and quantities of pesticides to apply to fields. Likewise, the livestock manager selects which products to buy for curing a sick animal and which sheep to put up for sale.

In other words, there is considerable independence within sectors when decisions are based on technical knowledge and skills alone. But decisionmaking within the community-based farm unit is never totally independent, because the interaction of the two sectors and the resources to support them must be considered jointly. This means that, in order to contribute to decisions that affect the production unit as a whole, sector managers must have at least a general working knowledge of all other components in the agropastoral system.

This knowledge is gained through an apprenticeship process in which children take part from an early age. Girls begin herding at their mothers' sides at age six or so, when they begin to learn about varying qualities of range, types of forage, diagnosis and treatment of different animal diseases, and other husbandry information and practices. At the same age, boys begin cultivating alongside their fathers and other elder males. But boys also herd when needed, and girls help out with planting and harvesting. In this manner, although girls specialize in animal husbandry and boys in cropping, both grow up with a general knowledge of techniques used in the sector for which the other gender is responsible.

This knowledge will be put to good use in the future, since adult women and men have well-defined roles to play in each other's production sector. For example, women are responsible for selecting and sowing seed, while men take charge of branding and docking animals. Again, these activities require special skills and technical knowledge. But more important, they give each gender an active "quality control" role in the other's sector of production. For example,

during seed selection, women take note of produce quality and quantity, and they have a say in the selection of crops and varieties to be planted the following season. Similarly, while branding and docking the household's sheep, men have an opportunity to review flock age and sex distributions and to gauge the animals' health and nutritional status. The experience gleaned from carrying out specific tasks in each other's sector gives women and men firsthand knowledge of crop and flock potentials, respectively. This furnishes them with criteria for meaningful participation in decisionmaking at the farm unit level. It also provides each a way to evaluate the production efforts of the other.

SUMMARY AND ANALYSIS

Three organizational strategies used by Andean communities to distribute risks in an adverse environment have been discussed. The implementation of these strategies is based on cooperative arrangements among and within different groups of people: community households, farm units, and genders. These groups and their associated organizational tasks can be classified into six types.

The first can be termed community-resource managers and consists of the communal assembly. It makes decisions on matters such as land distribution, use of communal pastures, and allocation of hydrologic and forestry resources. The second is the interhousehold labor exchange group, which cooperates across farm units to alleviate labor shortages in specific crop and livestock tasks.

Farm-unit managers comprise the third group. These consist of the adult members of the farm unit, usually a husband and wife. They jointly determine the unit's overall production objectives: what to plant during and across years and for what purposes (consumption, sale, social obligations); what species and breeds of animals to buy; which inputs to purchase or barter for in order to support the production effort. Although the father/elder male is usually the public spokesperson for this group, he is not the sole decisionmaker.

The fourth group is the production-sector managers. They are in charge of day-to-day farm operation. In the mixed production systems of high-altitude Andean communities, men supervise the crop sector while women administer the animal sector. Given this division of responsibility, sector managers have more knowledge and experience in certain specialized realms like soil quality, climatic conditions, and ox-team training (men), or animal health, reproduction, and range quality and capacity (women).

Quality controllers comprise the fifth type, in which specific adult members of the farm unit have precise technological knowledge in and longterm responsibility for certain subdomains of agricultural and pastoral production. For example, as noted earlier, women are in charge of seed selection and the sowing of tubers, maize, and broad beans (all of which are plants that are sown by placing the seed directly into the earth); but branding, docking, and training animals is men's work.

The sixth group, task implementors, is composed of all farm unit members who carry out tasks according to production needs, personal ability, and availability. For example, at any given point herding, weeding, and sowing may be performed by men, women, children, and elders depending upon individual physical capacity and technical skills. When all adult labor is otherwise occupied—as during harvesting, threshing, or branding—children or the elderly take over daily chores like herding, administering remedies and supplementary fodder to livestock, collecting fuel, and preparing meals for workparties. They may also help with lighter field tasks like removing the first tubers loosened at harvest.

It should be noted that this typology is a heuristic one. Throughout the world, in communities where women have longstanding ritual and productive ties to the soil, a relative equality between the sexes exists (Harman 1984:5). In the Andes, there are no overt taboos as to what gender or age may or must carry out which activities. As noted, tasks may be distributed according to immediate need and worker availability. And women (single mothers, widows, or those whose spouse is working elsewhere) often carry out specialized tasks in both the crop and livestock sectors. Furthermore, the composition and structure of households, farm units, and communities change as people migrate or as outside values are introduced. Nevertheless, this typology provides a tool for understanding the complex, organizational strategies that distribute agricultural production responsibilities among and between community households, farm units, and genders.

IMPLICATIONS FOR RESEARCH AND EXTENSION

In community-based agropastoralism in the Andes, crop, livestock, and resource management are carefully integrated. Likewise, the distribution of technical knowledge and skills, decisionmaking, and labor is organized in such a way as to guarantee efficient planning, production, and quality evaluation in both pastoralism and agriculture. Researchers and extensionists have long questioned why smallscale community-based farmers often fail to adopt "improved" agricultural technologies (Bilinsky and Gaylord this volume, Primov this volume). Many if not most of the technologies developed on experiment stations in Peru have not been incorporated into the farming systems of people who produce mainly for self-sufficiency. During the 1950s and 1960s, the common explanation for this was that the community-based farmer was too mired in tradition to accept new ways. She or he was thought to be content with the status quo, comfortable with a limited standard of living, and adverse to change. But traditionalism is not the main reason for the rejection of so-called improved technologies. It is increasingly evident that many of the alternatives designed on research stations require capital, labor, and ecological conditions that the small community-based farmer does not have. Technologies dependent upon external inputs may be beneficial in low-risk situations, but

they are often rejected by smallscale farmers in high-risk environments, where cash investments can all be lost in a single season.

To address the needs of community-based farmers, technologies must be designed and tested in situations that take into consideration the composite ecological, technological, and socio-organizational potential of smallscale production. In the latter regard, two questions are critical to research and extension oriented toward overcoming smallscale production constraints. First, *who* is making the decisions concerning resource allocation, production-unit objectives, and crop and livestock management? Second, *how* are production skills, responsibilities, and tasks organized across interhousehold groups and among men, women, children, and elders within the farm unit?

For example, in the Andean context described here, range and irrigation improvements should be proposed through the community assembly, since this group manages communal grazing grounds and water resources. It is the assembly who is responsible for husbanding existing resources and providing new and better ones for the community as a whole. However, suggestions to vary accepted fertilization levels, plowing methods, or certain veterinary procedures like dipping should be presented to the interhousehold workgroups, who share technological criteria that they implement jointly. It is unlikely that one member of an interhousehold workgroup would modify a production technique unless the whole group agreed to do so.

On the other hand, if recommended innovations might redirect the production objectives of the farm unit—e.g., a shift in the proportions of plant species cultivated or the introduction of improved breeds of sheep—then these must be discussed with the household adults, both men and women, who take part in such decisions. Illustrating further, introduction of selective breeding of livestock or of innovative seed storage methods should be presented to the appropriate sector managers—i.e., adult women in the case of Andean agropastoralists.

In sum, a straightforward, empirical understanding of who is making what decisions, at what levels of the production system, and which groups have responsibility for executing these decisions will allow researchers and extension agents to get the right information on practices and problems from and to the right people. Moreover, this understanding will direct testing of new ideas and possible alternatives to those most concerned and interested, those who are in a position to make decisions for change.

NOTES

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PART THREE

Agropastoral Systems: Change and Development

7

THE IMPACT OF ALFALFA INTRODUCTION ON COMMON FIELD AGROPASTORAL REGIMES: QUECHUA VILLAGERS IN SOUTHWESTERN PERU[1]

David W. Guillet

Intensifying agropastoral production is difficult and frustrating, particularly in complex mountain environments such as the central Andes. In mountains, vertical production zones often have communal forms of tenure, including communal control with indivisible use rights in high natural pastures and communal control with divisible use rights in mixed agropastoral zones (Guillet 1981, 1983; McCorkle this volume). The shift from communal to private control, often associated with the intensification of agropastoralism, may bring in its wake environmental degradation and the familiar "tragedy of the commons" (Guillet 1984, Hardin 1968). The risk is particularly great for fragile mountain environments, which are easily damaged by overgrazing, which can lead to erosion and loss of soil fertility.

This chapter describes the intensification of a native agropastoral system in Lari, a village in highland Peru. Since the 1960s, common fields have been enclosed and alfalfa adopted in response to population pressure and periodic droughts. The case is notable because villagers have been able to intensify their crop and livestock production with minimal damage to key environmental parameters. Moreover, this process occurred autonomously, without plan or intervention from outside agents.

TRADITIONAL PATTERNS OF LAND TENURE AND AGROPASTORAL REGIME IN LARI

Lari, a district capital in Caylloma Province of Arequipa Department in southwestern Peru, is situated at 3330 m on an alluvial terrace overlooking the

Colca River. The village is located in the Colca Valley, which is known for its extensive areas of ancient agricultural terraces.[2] These terraces make possible the irrigated agriculture that, together with sheep and cattle raising in the valley and llama and alpaca herding in the natural pastures above, provides the basis for a productive agropastoral economy. Aside from the recent changes to be analyzed in the present study, Lareños' overall ecological adaptation seems to have remained relatively stable since the Spanish conquest (Guillet 1987a). Table 7.1 summarizes the land types, locations, and tenures discussed throughout this chapter.

Agricultural Lands

Crops are grown on two kinds of land: housesite lands, of which there are three subtypes; and agricultural lands proper, which can be divided into fields under cultivation (chacras) and fallowing fields (puruma). The first, housesite lands, can be classed into three subtypes.

Housesite Land. A *canchón* is an irrigated, fenced plot located adjacent to village houses. Canchones may be used either for intensively cultivated early, *mishka*, crops of broadbeans and barley or for corralling animals at night. Over time, animals corralled in canchones produce extremely rich soil with their manure. The manure is also collected and used in maize cultivation. A *galpón*, the second subtype of housesite land, consists of the area bounded by the remaining walls or foundation of an abandoned dwelling. These areas, too, are used to grow special crops; the walled and slightly sunken perimeter of the abandoned house provides a protective frost-resistant microclimate. Galpones are especially preferred for raising eucalyptus trees. The third type of housesite lands are *huertas*, intensively cultivated kitchen gardens. Located within canchones, they are used to raise herbs and vegetables and to experiment with new cultivars and techniques.

Fields. Lari's agricultural lands proper are scattered throughout the village territory in a belt between the Colca River bottom at 3200 m and the current upper limit of agriculture, at approximately 3600 m. Approximately 805 ha of land are in agricultural use in the village, or 8.8% of all usable land.[3] Production is oriented to the subsistence cultivation of maize, followed in importance by barley, broadbeans, and a host of lesser cultivars.

Virtually all agricultural plots are located on rock-faced terraces and are irrigated. While yoked oxen are capable of plowing most plots, hand implements are necessary to work terraces too narrow for animal traction. Lari's irrigation system is remarkable for its complexity and efficiency (Guillet 1987b). Water is brought down from sources in the *puna* through three major canals from which it enters numerous feeder and branch canals. It is diverted from main canals to offtakes, called *tomas*. These are identified with named groups of contiguous

TABLE 7.1 LAND USE TYPES IN THE COLCA VALLEY

LOCAL TERM	LOCATION	TRADITIONAL TENURE[a]	CONTEMPORARY TENURE	USE
Housesite Lands				
Canchón	Adjacent to houses	Private	Private	Cultivation, animal corral
Galpón	In village	Private	Private	Houseplot
Huerta	Within canchón	Private	Private	Kitchen garden
Agricultural Lands				
Chacra	Dispersed, 3200-3600m	Private/ communal-indivisible[b]	Private	Cultivation, communal grazing
Puruma (chacra in fallow)	Dispersed, 3200-3600m	Private/ communal indivisible[c]	Private	Grazing
Grazing Lands				
Batadero	Above 3600m	Communal-indivisible	(1) Communal-indivisible (2) Private collecting	(1) Grazing, collecting (2) Grazing
(Outcrop)	Dispersed 3200-3600m	Communal-indivisible	Communal-indivisible	Grazing, collectiong
Pampa	Dispersed, 3200-3600m	Communal-indivisible	(1) Communal-indivisible (2) Private	(1) Grazing (2) Houseplot cultivation, kitchen garden, animal corral
Terreno eriazo	Dispersed, 3200-3600m	Communal-indivisible	Communal-indivisible	Grazing

[a]For definition of land tenure types, see Guillet 1981. Altitudes are approximate.

[b]Tenure alternates between private, during the cultivation cycle, and communal-indivisible following harvest, until soil preparation at the beginning of the next cultivation cycle.

[c]Tenure alternates between private — during the cultivation cycle, when the owner uses the field for cropping or, if he chooses to leave it in fallow, for grazing — and communal-indivisible following the harvest and continuing until the beginning of the next cultivation cycle.

plots within which the water obtained from an offtake of a major canal is distributed. There are 14 tomas carved out of the land irrigated by the three major canals. Each week, users from each toma meet with a water judge who assigns watershares.

Cultivated plots, chacras, can be located wherever soil of adequate depth and quality and sufficient water are available at a suitable altitude. Virtually all chacras are irrigated. Land can also be in longterm fallow, puruma. In traditional maize cultivation a plot was planted to maize for three to ten years, depending on soil quality, and then fallowed for three to four years. About one in four hectares were in fallow during 1978. During the agricultural season, chacras are under private control. The owner decides on the crops to grow and the cultural practices to follow. The decision to fallow or to cultivate a field is entirely his own. A strong ideology of household autonomy lies behind these decisions. The notion that communal controls restrict this freedom is soundly rejected.

Reinforcing the ideal of household autonomy is a free and active market in land. Any plot can be bought, sold, rented, sharecropped, or otherwise transferred to local villagers or to outsiders. Sales are registered before a land judge, and properties are declared for tax purposes. It is clear that agricultural plots are the basis of a land market in which prices are regulated by supply and demand.

Up to this point, the use of irrigated plots fits the model of private control described for continuous agriculture (Guillet 1981). However, in a departure from that pattern, traditional practice in Lari held that after the harvest, private chacras were opened to communal grazing on the stubble. During these periods of unrestricted grazing, irrigation tomas became communal grazing grounds. These divisions were based not on fallow/cultivation sequences as in sectoral fallowing (ibid.), but rather on the spatial organization of water distribution. There were no walls within tomas to inhibit the movements of animals or to enclose private plots. Water plays a much more important role in Lareño agricultural production than anything else; so it is not surprising that it also indirectly structured the traditional organization of communal grazing. The dates for the sequence of harvesting in the tomas were set by village authorities and were influenced by the timing of the first irrigation of each toma. This date was announced by irrigation officials at the start of the agricultural cycle each year. Low tomas on the west side of the village were irrigated first and thus harvested first (Figure 7.1). As the harvest moved from the west to the east of the village, successive tomas were in turn opened for communal grazing.

During and after harvest, llama caravans descended to the valley from the puna, the high-altitude pasturelands far above the village. The caravans brought puna products like jerked meat, hides, and freeze-dried potatoes (*chuño*) to exchange for maize and barley. The llamas were also used in transporting Lareños' harvested crops from field to house. Llama caravaners were required

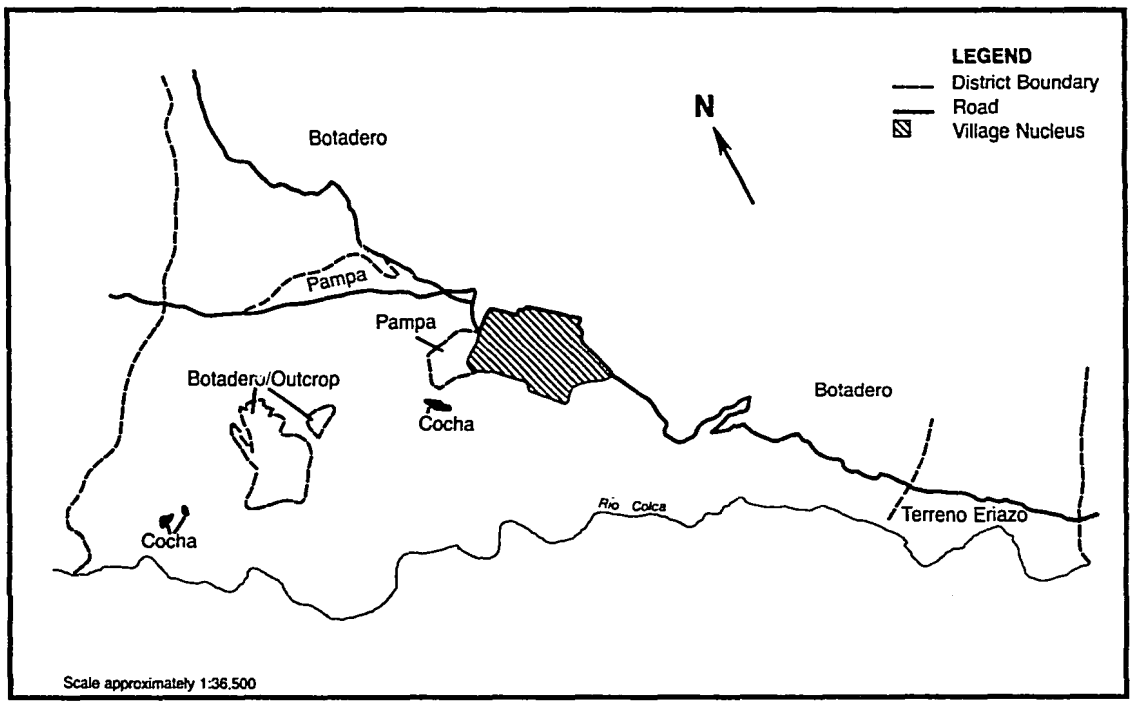

FIGURE 7.1 SKETCH MAP OF MAJOR COMMON FIELDS OF LARI

to pay for pasture rights, *yerbaje*, to graze their animals on the village's common fields.[4]

Communal Grazing Lands

Botaderos. Natural pastures, called *botaderos*, are used for communal grazing and are found in several locations in Lari. Some lie in a belt on the slopes behind the village above the upper limit of cultivated terraces at about 3600 m (Figure 7.1). This degraded, sloping land provides grasses for Lareño herds during the rainy season. Animals grazed in botaderos include, in decreasing order of importance, sheep, cattle, donkeys, horses, and goats.

These upper, common pastures are part of Lari's communal property, which extends to the crest of the mountains above the village. The pastures are accessible by a network of footpaths that connects the village with the puna *estancias* (small ranches managed by puna pastoralists) on the other side of the mountains. The closest common pasture is a 20-minute climb upwards from the village nucleus; the most distant takes about an hour to reach. Communal lands are ideally open to all villagers. Any Larenño can pasture her/his animals on this land, and can collect firewood, medicinal and culinary herbs, water reeds from marshy lakes for forage, and building materials such as stone. Such land cannot be sold or claimed as private property.

While there is an ideal of open access to botaderos, transfers to private use have occurred. Some transactions are legitimate, based on an open and consensual decision by the community, often recorded in the District Council minutes. Others are illegitimate, deriving from a village official's illicit sale of communal property to an individual. Villagers characterize illegitimate sales as an *abuso*, or abuse of authority.

An example of a legitimate private use of botadero lands is Chipta, the mountain slope immediately behind Lari. Chipta is clearly perceived as part of the village's heritage. Yet when Lareños discuss family pastures, Chipta is said to be "owned" by the Mamanis, a large and important family whose members possess irrigated terraces in the valley and extensive pastures in the puna. The Mamanis' claim to Chipta rests on a legend about the family's contribution of *silar*, volcanic rock, for the construction of the village church in 1758 (Valdivia 1847:122). Silar comes from deposits near Caylloma in the puna above Lari. In view of the Mamanis' generosity, the village assigned the family rights to use Chipta mountain in perpetuity, albeit with certain restrictions (see below). The practice of granting communal land to individuals in thanks for their civic generosity or exemplary effort on behalf of the common good is not unusual; other examples can be found in Lari across the last 30 years.

Like the rest of the Mamamis' pasture lands, Chipta is managed as a family enterprise. A manager, called a *cabecilla*, is chosen by consensus from among

the most competent, older, and trusted family members. He exercises absolute authority over the land; it is his job to apportion the land into separate pastures and assign them to individual family members. In theory, anyone who carries the surname Mamani has access to Chipta pastures. But in fact, with the accedence of close family members, the cabecilla can effectively block access to Chipta land by distant kinsmen.

Chipta is not, however, a private preserve of the Mamanis. A convenient and accurate index of private ownership is the declaration of a parcel for tax purposes during the annual self-assessment, *auto-evalúo*. This involves completing a form listing an owner's plots, their locations, and sizes. Tax on the plots is then calculated with a simple formula. Declaring a parcel in the auto-evalúo usually indicates that the owner holds title to the plot.

While the majority of estancias in the puna are considered private property and are declared for tax purposes, this is true of only one of the botaderos on the slopes (not Chipta). The botaderos' rather unclear legal status reflects their ambiguous, mixed use. The village has traditionally reserved the right to graze animals in botaderos for a 20- to 30-day period scheduled by village authorities each year. For example, an entry in the District Council minutes for 1977 decrees that animals were to be allowed onto the communal pastures of Umaro Pampa, Chipta, Uruquipa, Huayllincuña, Cuchuruma, Tomallihua, Morro de Uchuruta, and others, beginning on 15 September. The movement of animals onto communal pastures roughly coincides with the beginning of the agricultural calendar. Herds are thus removed from the fields, which must then be plowed and seeded; and later, during the height of the rainy season, animals must be kept out of muddy corrals.

Outcrops, Cochas, Pampas, and Terreno Eriazo. Aside from botaderos in the belt of abandoned terraces above the village, village commons are also found atop rocky outcrops, alongside marshy lakes (*cochas*), on flats (*pampas*) on the upper shelf of land behind the village, and on terraces that have been abandoned (*terreno eriazo*) for lack of water (Figure 7.1). With the exception of village commons in the upper reaches of the community (see below), these lands have never been transferred to private use; they have been and remain communally controlled open fields.

Most of the types of village commons mentioned so far are unsuitable for agriculture because of the land's excessive slope or its insufficient topsoil; but they are useful for grazing. Communal grazing lands accepted animals at the beginning of the agricultural cycle, when grasses began to grow after the onset of the rains. At the end of harvest, animals were moved onto the fields to graze the stubble and add valuable manure to the soil. In some cases, forage was supplemented with the stored stalks of maize or with barley harvested while green.

ALFALFA INTRODUCTION AND CHANGES IN LAND TENURE AND AGRARIAN REGIME

Alfalfa Introduction

Alfalfa was introduced into the lower valleys of southwestern Peru by Spanish colonists in the 16th century. Its diffusion into the highlands came later, probably in the 19th century after a cold-resistant variety was developed. Lareño church records from the mid-19th century contain a reference to the purchase of alfalfa seed for cultivation in the church garden, traditionally a site for agricultural experimentation. The earliest date of alfalfa adoption among the informant sample is 1947. But according to a land-use survey administered to 55 household heads, massive adoption of alfalfa in Lari began in the 1960s. The bulk of adoptions occurred during the 1960s and 1970s. By 1978, when a cadastral survey was carried out, 25% of all village fields (n = 1805) were in alfalfa.

One reason for alfalfa cultivation is to fatten cattle for sale to middlemen who transport the animals to coastal cities and mines for resale. Alfalfa is known to be a higher-quality forage than native grasses and crop stubble. Also, wage laborers who work for the Madrigal mine in the adjoining village of the same name purchase cattle and rent alfalfa plots from Lareños. However, most informants cite scarce and declining rainfall as their reason for alfalfa adoption. Alfalfa is a hardy, drought-resistant cultivar. It has long roots that conserve moisture during dry periods and allow the plant to recover quickly following a frost. Moreover, according to Lareños, alfalfa grows well on sandy, infertile soils and in locations not suitable for maize. Many farmers now cultivate alfalfa during the traditional fallow period that follows several years of maize cultivation. The alfalfa provides good green forage for animals and improves the soils.

Lareños are not alone in suggesting a trend to declining rainfall. Antuñez de Mayolo R. (1981) has argued that this is part of a general pattern of increasing aridization in the central Andes. Substantiating such a trend with the available data is difficult, however. The longest series of rainfall figures for the Colca Valley comes from a weather station at Yanque that began measurements in 1951. These records reflect a pattern of extreme irregularity and periods of very low rainfall, including 1956–1960, 1964–1969, and 1975–1982. Average annual rainfall for the entire 32-year period (1951–1982) was 418.4 mm. These data do not support a pattern of significantly decreasing rainfall. Regression analysis reveals a slight decrease of 3.27 mm per year over the period, but is not statistically significant ($t = -1.166$). A longer, 48-year series (1931–1979; data missing from 1932) from Chuquibambilla in the Province of Cotabambas also fails to substantiate a longterm trend of decreasing rainfall. In fact, it reflects a slight increase of 1.94 mm per year ($t = 1.299$) over the period in question.[5]

Although the available data do not entirely support claims of an overall decline in rainfall, they do show that rainfall is generally quite low, very irregular,

and subject to a pattern of periodic droughts. Each of these factors is a major constraint to both agriculture and pastoralism and would in itself produce competition over scarce resources such as pasture. However, a more compelling reason for additional demands for forage and pasture, albeit one not recognized by villagers, is population growth. Population in the district of Lari, which includes the nucleated settlement plus the dispersed estancias, has grown consistently. This is evidenced in the last four censuses: 789 (1940), 820 (1961), 1239 (1972), and 1156 (1981). It is probably no accident that the beginning of alfalfa adoption coincided with the major growth spurt of the 1960s. At the same time two of Lari's largest common fields, Chillema Pampa and Tomallihua Pampa, were dismantled. The former was converted to additional chacras and the latter to housesites and canchones. The net effects of out-and in-migration on population have not yet been fully analyzed, and there is reason to believe that out-migration since about 1960 has ameliorated population increases arising from births and in-migration. Nevertheless, there is substantial evidence that population pressure has increased competition over village resources and accelerated the movement away from communally controlled open fields.

The Enclosure Movement, 1960–1984

Cultivating alfalfa, a semi-perennial, has provided an important supplementary source of high-quality forage. Yet it has resulted in a shift from communal grazing on the stubble of harvested fields to completely private control of these fields. The construction of adobe fences to demarcate property lines and restrain animals is the final blow to the system of communal stubble grazing. This process began around 1960, about the same time that alfalfa started to be adopted on a large scale. At that point, pressures for the privatization of communal land, felt in the village in past generations, increased dramatically. This led in turn to transformations in the way these lands were used. In some instances, the shifts took the form of classic enclosures, comparable to those reported by Mayer (1979) for villages in the Cañete Valley. I.e., large, open common fields were divided into individual parcels, fenced, and transferred to individual owners. In other instances, private users of common lands prohibited communal access. And in still other cases, pressures to privatization were successfully resisted.

By the early 1980s, the system of communal grazing on the stubble of harvested chacras had been completely dismantled in Lari. Grazing on harvested land is now done by the household on its own plots. The herds of other villagers are no longer allowed access to the stubble of an individual's plot. Many aspects of this transformation can be linked to the introduction of alfalfa during the same period. On the flats, it was necessary to construct walls to fence in herds that now could be grazed during the normal agricultural cycle alongside cultivated plots; without the new walls, animals would damage these crops. In

terraces used for alfalfa production, it was also necessary to restrict animals' movements by constructing adobe walls on top of terrace end walls. No longer is there a fixed village harvest period, since alfalfa can be grazed at any time; nor are there open communal pastures at the end of harvest.

For botaderos there have been two patterns of transformation. In botaderos that had been legitimately transferred to mixed communal-private use, the trend has been for "owners" to exert private rights to the land, prohibiting other villagers' traditional rights of annual grazing and collecting. By and large, in what would otherwise seem to be a conflict-laden competition over scarce pasture, the community has not contested this move. In botaderos that had been under communal control with indivisible use, new transfers to private control without traditional communal access occurred in a majority of cases. In the following analysis of these two types of transfers during the period in question, transactions recorded in the minutes of District Council meetings are defined as legitimate and all others as illegitimate.

Across the last 20 to 30 years, communal grazing lands located on pampas to the west of the village have been slowly converted into privately controlled houseplots, canchones, and huertas. The first reference to these transfers in the minutes is in June 1966, when limits were placed on land that could be sold to individuals for these purposes. We can assume that, in light of the need to regulate these transfers, such transactions had been going on for some time. Most of them occurred in 1970–1974 during the first phase of a radical agrarian reform (Perevolotsky this volume) enacted by then-president Juan Velasco.

One area on the western edge of the village is of special interest. Early in 1972, it was divided into numbered houseplots and declared an *urbanización* on the subdivision model of urban land development then being carried out in Arequipa City. In the council minutes, transactions involving land in this area bear an urban plot, *lotización*, number. In an entry on 26 September 1981, the last such transfer is recorded, along with a statement that no more communal land remained in or outside Lari. In the majority of the transactions noted in the minutes ($n = 22$), individuals were sold a plot of 25 to 50 m^2 for a house, a canchón, and a huerta. Many of the recipients were natives of the high provinces in the Departments of Cuzco and Puno, from which llama caravans annually descended to the Colca Valley to trade highland products for barley and maize. The caravaners typically established favored trading partnerships with Lareños; when land became available, these visitors were thus in a good position to buy into the village.

During the same period (1970-1981), communal land located on the flat, unterraced shelf some distance from the village was sold for conversion into chacras and alfalfa meadows. In many ways, these transactions complemented the conversion of communal land adjacent to the village into houseplots. For some of the new residents, the newly created chacras supplied part of their subsistence needs and supplemented other land purchased from individuals or obtained through indirect means, such as sharecropping.

There is reason to believe that illicit sale of terreno eriazo (abandoned land that had reverted to communal control) for agricultural plots was more common than for "urban" land. Illegitimate transfers are of course more difficult to document because by their very nature they are covert. Although a few cases in which the community denounced an illegal sale are recorded in the village minutes, the incidence is doubtless much greater. Such transfers are clearly a subject of much contention. Other communally controlled open areas such as cochas have resisted the trend to privatization, however. They remain open to all villagers.

DISCUSSION

The introduction of alfalfa into the agropastoral economy of Lari has intensified the productivity of land and labor. Cultivating alfalfa, instead of leaving fields to naturally fallow, gives livestock access to a much higher quality of forage than the wild grasses that would have grown there. Agricultural production following the return of the field to cultivation is higher, too, due to the soil-enhancing qualities of alfalfa. Overall, access to forage is made more secure in that alfalfa adjusts well to the prolonged periods of drought and the occasional frosts that are the bane of Andean agropastoralists.

This process has involved much the same kinds of shifts that elsewhere are associated with the intensification of traditional agropastoral regimes (Guillet 1984). Common fields have been "enclosed" and private control has displaced communal control to a much greater degree. Yet there is no evidence of massive erosion and decline in soil fertility, two of the key indicators of degeneration in land use systems. In fact, the shift to alfalfa has likely improved fertility. Soil analysis in neighboring Coporaque shows extremely high fertility and good soil structure. Yields for barley (1.2 tons/ha) and wheat (1.7 tons/ha) are comparable to average U.S. yields (1.7 tons/ha for barley and wheat).

To what extent has the introduction of alfalfa led to increased pastoral production for market at the expense of agricultural production for home consumption? Such a shift ensued in the Department of Arequipa in conjunction with the expansion of a dairy industry fomented by foreign capital. But these tendencies have been held in check in Lari for three interrelated reasons. First, alfalfa is perceived as a way to place animal husbandry on a more secure basis, rather than as a way to expand it. Alfalfa cultivation is restricted to land taken out of maize production and normally left to fallow. Hence cultivation of this forage has not expanded at the expense of land devoted to the production of food plants for humans. The village remains strongly subsistence-oriented, with households raising their own maize, broadbeans, and barley for local consumption. Second, irrigation authorities have been very careful to safeguard the subsistence orientation of local production by restricting the allocation of water for alfalfa to periods when demand for water for foodcrops is low. They are aware that a complete shift to alfalfa, as has occurred in the *pampiña* of

Arequipa, would reduce villagers' ability to grow food for home consumption and force them to depend on other sources of income, of which there are very few in the region. Lastly, the distance from Arequipa is such that dairy production is only marginally feasible, given the costs and rigors of transport.

Farmers in Lari adopted alfalfa and made the transformations in their agropastoral system in an incremental way, monitoring the results as the process proceeded. They are aware that their control over botaderos has slipped, in many instances thus diminishing their access to communal pastures. This has not become a critical issue, however, precisely because alfalfa now offers, in both its fresh and dried forms, a much more secure supply of forage. Hence the emergence—anomalous by Andean standards—of private forms of tenure concomitant with increased and more secure access to productive resources.

NOTES

1. This chapter reports on research conducted under Grant No. AID/DSAN/XII-G-0049 of the SR-CRSP in collaboration with Peru's Instituto Nacional de Investigaciones Agropecuarias and the Universidad de San Agustín in Arequipa. The author was awarded a research leave by the University of Missouri-Kansas City in order to carry out the study. Additional support was provided by the University of Missouri-Columbia. I wish to thank Jere Gilles and especially Constance McCorkle for their insightful comments on earlier drafts of this chapter.

2. The cultural ecology, archaeology, and history of terracing in the Colca Valley is the subject of a report by Denevan 1986. See Guillet 1987b for a discussion of the relationship between irrigation and terracing in Lari.

3. Approximately 8550 ha or 90% of Lari's usable land consists of natural pastures on the slopes and the undulating plateau (puna) above the village. This land is exploited by herders who live in small dispersed ranches (estancias) and rotate their herds from pasture to pasture. Although these puna herders belong to the political district of Lari, their social and economic organization reflects a "pure" pastoral adaptation. Hence they are not discussed here.

4. For example, in an entry in the minutes of the District Council of Lari for 10 May 1986, one *soga* (a woolen rope) was charged for each ten llamas. Fifteen *soles* could be paid in lieu of a soga. The council authorized eight days of pasture for each herd that arrived.

5. I want to thank Bruce Winterhalder for supplying me with the rainfall data from Chuquibambilla.

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8

OUTREACH PILOT PROJECT: SMALL RUMINANT RESEARCH AND EXTENSION IN JAVA[1]

Paula Bilinsky and Mark Gaylord

Indonesia is a nation made up of more than 13,000 islands. This includes one of the globe's largest islands, Sumatra, and parts of New Guinea and Borneo. The population of Indonesia as a whole numbers more than 170 million, making it the fifth most populous country in the world after China, India, the Soviet Union, and the United States. By the year 2000, Indonesia is expected to have nearly 223 million inhabitants. During the next two decades the country will face the most serious challenge of its 40-year history as it strives to educate, house, employ, and feed this burgeoning human population. Today 56% of Indonesians work directly in agriculture (WIIAD 1986:II-11). Agricultural products provide roughly a third of Indonesia's gross domestic product (GDP). Considering all such products together (including foodcrops, estate crops, livestock, forestry, and fisheries), foodcrops contribute 58% of that one-third of the GDP (MOA 1980:31).

The Outreach Pilot Project (OPP) is a farming systems research and extension project designed to address one aspect of food potential in Indonesia—the production of meat from small ruminants. Initiated by the Small Ruminant Collaborative Research Support Program (SR-CRSP) and the Indonesian Research Institute for Animal Production (BPT), the OPP has functioned in Bogor, West Java since 1984. This chapter outlines and evaluates the evolution of the OPP and, based on lessons learned from it, suggests likely future directions for this and other such projects.

INDONESIAN FARMING SYSTEMS

The Cropping Sector

Indonesia is situated in the humid tropics and has very fertile volcanic soils. Foodcrops and estate crops form the backbone of its rural economy. By far the

most important foodcrop is rice. Land devoted to rice production alone is greater than that of all other staple crops combined (MOA 1980:33). Aside from these general observations, however, farming systems vary greatly throughout Indonesia, from slash-and-burn horticulture in Central Kalimantan (Borneo), to mixed crop/livestock production in west Sumatra, to intensive rice farming on Java.

Within Java itself, farming systems are highly diverse (Sabrani et al. 1982, Suradisastra and Nolan 1983). The island is characterized by three major cultivation zones, defined primarily by elevation. Each is associated with a particular cropping profile. In the lowlands, wet rice farming is the predominant pattern; in the upper-elevation slopelands, the revenue-producing estate crops such as coffee, tea, cocoa, rubber, and spices are grown; and in the highlands, intensive vegetable production is the norm (Blond 1984:56).

Given that Indonesia confronts one of the world's highest population densities, it is not surprising that foodcrop-based farming systems on tiny land holdings are the norm. Family farms generally average just 1.69 ha nationwide (WIIAD 1986:II-10). They are even smaller on Java, where nearly 100 million people occupy an area approximately the size of California. In recent years Javanese farm sizes have declined precipitously, to an average of only 0.3 ha (ibid.).

The Livestock Sector

Few Indonesian farmers raise only crops. Nearly all households keep some livestock, whether chickens, ducks, cattle, water buffalo, or sheep and goats. There is considerable interdependence between plant and animal domesticates in Indonesian farming systems. Plant crops provide critical livestock feed in the form of residues and byproducts. In return, animals provide draft power to till the fields, and their manure furnishes fertilizer for both foodcrops and high-value cash crops like fruits, spices, and vegetables. Livestock thus enhance the overall efficiency of the farming system. Small ruminants play an especially important role in this regard. One out of every five farmers in Indonesia raises sheep and/or goats. Unlike large ruminants, sheep and goats can be profitably raised on the small hectarages worked by most Indonesian farmers. Large ruminants are difficult and uneconomic on such small holdings. As household land holdings have shrunk, therefore, sales of cattle and water buffalo formerly used for draft power have markedly increased. This is especially true in western Java, where declining farm sizes combined with increasing demand for meat from large urban markets have led to diminishing numbers of large ruminants. Concomitantly, the importance of small ruminants in Indonesian farming systems has grown.

Because small farms have little land for grazing or fodder production, intensive cut-and-carry confinement or semi-confinement husbandry systems for small

ruminants have become well developed. Fueling this trend are intensified agricultural systems and higher rice yields, which have in turn increased the supply of crop byproducts and residues available for feed. Tree crops also provide a wide variety of livestock feeds, as do grasses and leaves gleaned from hedgerows.

For small farmers and the landless, sheep and goats can be a substantial source of income. Small ruminants earn just over a tenth of landed producers' farm income in Indonesia; for landless producers, sheep and goats account for double this figure, or one-fifth of farm income (Pryor 1986:2). The animals also act as a form of savings and capital investment (Perevolotsky this volume). Rather than putting cash in a savings institution, rural families buy sheep and goats to keep for major household needs like weddings, school fees, or religious celebrations. Sheep and goat meat is especially important at religious feasts and holidays when other meats may not be eaten. In the month in which Idul Adha falls, for instance, sales of small ruminants may double (Pryor 1986:1). In short, the 3 million sheep and 7.5 million goats found on Java play a vital role in the socioeconomic survival of smallholders. More broadly, livestock contribute approximately 10% of the total value of farm production on Java (Blond 1984:56). And the Indonesian livestock sector as a whole satisfies most of the national demand for meat and eggs. Livestock therefore constitute a critical component in both rural-household and national economies of Indonesia.

BPT AND SR-CRSP: PARTNERS IN RESEARCH

Small ruminant research in Indonesia is conducted through the Agency for Agricultural Research and Development, an arm of the Indonesian Ministry of Agriculture. The Central Research Institute for Animal Science, CRIAS, is an umbrella organization that oversees the work of two institutes: the Research Institute for Animal Production, known as BPT; and the Research Institute for Veterinary Science, or BPV. Scientists in these two institutes collaborate with other researchers, educators, and extension specialists to improve livestock production in Indonesia.

Since 1980, BPT and SR-CRSP have been working together to solve some of the nation's most pressing problems of sheep and goat production. In Indonesia, the SR-CRSP spans four disciplines: animal nutrition, genetics, agricultural economics, and rural sociology. Each discipline is represented by a BPT scientist and an expatriate counterpart scientist employed by the SR-CRSP. The nutrition program has centered on feeding trials at BPT experiment stations, using feeds available at the village level. The breeding program has been working to establish performance parameters for local races of sheep and goats and to improve breeding management practices. The rural sociology and agricultural economics projects have focused on characterizing the socioeconomic configuration of

Javanese farming systems, along with constraints to and opportunities for improving livestock production.

In today's Indonesia, most sheep and goats are managed in much the same way as half a century ago. Yet technologies now exist that can greatly increase small ruminant production. Many of these techniques have been developed and proven in other countries. SR-CRSP and BPT are trying to adapt these new technologies to fit into Indonesian farming systems in order to solve local production problems. The long-range goal is to raise the incomes of smallholders and at the same time increase the supply of animal protein to Indonesian consumers. (But, see Primov this volume.) The prospects for achieving these goals in Indonesia are good. Current production of small ruminants at the village level is about one offspring per year per adult female, with a lamb growth rate of 20 to 40 g per day. However, research-station experiments indicate that productivity could be raised to two offspring per breeding female per year (Obst et al. 1980:121). This could be achieved through a number of management interventions.

First, the genetic resource base of adapted livestock among sheep and goats is adequate for gradually improving production levels. For example, the sheep breeds found on Java display a continuum ranging between two main types: the Javanese thin-tailed hair sheep, and the fat-tailed wool sheep. Both are highly fertile, but of low mature live-weight. Also, lamb mortality tends to be high, partly because of low birth weights and partly because of unpredictable multiple births. The major caprine races are the Kacang or "peanut goat" and the Etawah. Both are raised primarily for meat. However, for both sheep and goats, smallholders rarely institute any planned breeding program, despite the fact that the animals mate yearround. A breeding season based on feed availability or market demand would improve productivity greatly (see also Mendes and Narjisse this volume).

Second, higher quality feeds plus nutritional supplements would accelerate and increase weight gains in small ruminants and would enhance the general vigor of the animals, particularly females. While crude protein levels of village diets for small ruminants appear acceptable, digestible energy intake is a limiting factor in present feeding systems. However, remedies are at hand in the form of native grasses, crop byproducts, and tree legumes.

Third, poor health—most notably, internal parasites and mange—is a constant problem among smallholders' sheep and goats. Periodic drenching could virtually eliminate the internal parasite problem.

In sum, BPT and SR-CRSP research conducted at the level of the experiment station suggests that by adapting existing technologies to modify breeds and breeding strategies, feeds, and health care, small ruminant production could be significantly improved. To do this, however, it was imperative to test experiment-station findings under village conditions.

THE OUTREACH PILOT PROJECT

The OPP was begun in 1984 as the logical first step in the process of moving research and researchers out of BPT's experiment stations and into farmers' fields and animal houses. However, encouraging scientists to leave their offices and engage in fieldwork proved one of the SR-CRSP's greatest challenges. As in most developing countries, Indonesian scientists, even agricultural scientists, generally come from urban backgrounds. As members of the middle class they anticipate a professional life of research publications, computers, comfortable offices, and clean hands. Yet these expectations run counter to the kind of intimate experience with farms and firsthand dialogue with farmers that is essential to relevant, applied research in agriculture.

From the beginning, then, OPP was designed to encourage BPT scientists to work *with* producers as partners in the research and development (R&D) process and as purveyors of a vast storehouse of knowledge acquired from centuries of managing their own crop and livestock enterprises. The aim of strengthening the dialogue between farmers and researchers was to stimulate BPT scientists to think creatively about farmers' production problems, to encourage them to listen to farmers as they described their own particular needs and situations, and then to incorporate producers' perspectives into the scientific research agenda (Knipscheer and Suradisastra 1986, Mawi and Gaylord 1986).

In the long run, of course, agricultural research seeks to improve farmers' lives by increasing farm efficiency, raising farm income, and thereby enhancing human well-being. To the extent that farmers become a meaningful reference group to BPT scientists, research should become increasingly problem-centered and practical. Enhanced farmer-researcher dialogue should also speed up the pace of research by placing newly developed technology into farmers' hands as quickly as possible in order to test its validity and acceptability. Farmers' assessments can then be fed back into the R&D process.

Beyond this initial objective of enhancing farmer-researcher interaction, the OPP seeks to test and demonstrate new technologies, breed genetically superior animals, and promote collaboration among livestock extension agents, BPT and BPV researchers, and expatriate SR-CRSP scientists. The overarching goal is to improve farmers' sheep and goat husbandry by increasing their awareness of the impact of different management strategies on small ruminant production.

OPP Structure and Operations

In order to accomplish these goals, the OPP was organized as follows. Together with livestock extensionists from western Java's Bogor District, BPT scientists identified 15 villages to participate in the OPP. Within each village three to five producers were brought together to form "farmers' groups." Care was taken to insure that all agroeconomic zones within Bogor District were

represented in the village sample, and that participants spanned a wide range of socioeconomic types. Some OPP participants were landless, while others owned as much as 5 or 6 ha of irrigated rice land. Groups included both longtime livestock producers and relatively inexperienced stockraisers. The majority of participants considered farming their principal occupation. Each farmers' group was organized around a field laboratory that consisted of a barn built with project money on the land of one group member. These laboratories serve three functions: as a testing ground to try out new techniques, as a demonstration farm to spread knowledge of new technology to neighboring producers, and as a multiplication center for breeding genetically superior animals.

The OPP alloted six sheep or six goats (five females and one male) to each farmers' group. Each group signed a contract with BPT stipulating that over the next five years the group would return ten female and one male offspring to the OPP. Following a pattern of shareherding found in Indonesia as well as in many other parts of the world (McCorkle this volume, Perevolotsky this volume), for each ewe or doe received by a farmers' group, the second offspring would be remanded to the district livestock extension service (Dinas Peternakan) and the fourth offspring would go to BPT. Dinas Peternakan and BPT would then redistribute these animals to other farmers in Bogor District. This shareherding contract will expire after five years, at which time the barn and all remaining animals will be fully owned by the farmers' groups. In effect, these groups constitute small corporations with collective responsibility for managing a flock. Although the groups are artificial social institutions in the sense that they have been created solely for the purposes of OPP, they closely parallel village conditions and practices in a number of important respects, e.g., small flock size, shared stud animals, traditional animal-house architecture and construction materials, and stockraising as a complement to cropping.

OPP staff work closely with the farmers' groups, supervising veterinary and husbandry practices and visiting each group once a month to administer treatments and record information on the test animals' weight, size, and health status. OPP scientists also collect data on labor input, flock breeding and growth performance, and types and qualities of feedstuffs. A BPT scientist from each of the four SR-CRSP disciplines working in Indonesia participates in the monthly monitoring, along with her/his expatriate SR-CRSP counterpart. Once a year there is a joint meeting among farmers, extension personnel, and BPT and SR-CRSP scientists to discuss problems and issues within the project.

OPP efforts initially focused on two management techniques not generally used by most small ruminant producers in Java—feeding mineral supplements for increased nutrition, and drenching for parasite control. As new elements are added to the technology package provided to OPP farmers, their perceptions of the innovations are evaluated. On the basis of nearly one and a half years of monthly monitoring plus two surveys of animal performance and farmers' perceptions of the project, a preliminary assessment of OPP success is possible.

OPP Outcomes

In general, participants in this project have found it useful. In large part, their positive evaluation relates to the fact that the OPP differs from conventional small ruminant research and extension initiatives in Indonesia, in which animals are merely distributed to farmers without any management recommendations (Amir et al. 1986:2). The majority of OPP participants clearly see a marked difference in the health and vigor of the test animals compared to their own household flocks. They also appreciate the superior breeding qualities of the OPP stock. As one SR-CRSP survey found, "The ram provided by the OPP staff is in the eyes of the farmers perhaps the most important component of the technology [package]" (Amir et al. 1986:7).

The same survey also found that OPP farmers are very concerned about the labor inputs of their production system. This is closely related to the fact that, in general, plant crops occupy much more of a household's available labor. Most farmers do not view livestock production as a top priority in allocating their scarce household labor. This factor no doubt accounts for OPP participants' favorable response to mineral supplements. As BPT experiments have demonstrated, supplements significantly increase animal growth rates and decrease lamb and kid mortality; yet they require no real labor inputs. Other SR-CRSP research (Subandriyo 1985) has confirmed that the first three months after birth are the most critical in determining the future health and performance of small ruminants. Reduced lamb and kid mortality and healthier and faster-growing offspring mean increased production for the smallholder without a corresponding increase in labor.

As with genetically superior rams and mineral supplements, drenching for internal parasites was also viewed favorably by survey respondents. At present, the mineral supplementation and the drenching treatments are paid for entirely by the project. The farmers' groups are primarily involved in the daily management and care of the test animals, while OPP staff are responsible for the purchase and administration of the drenching medicine. But this is an artificial environment (Amir et al. 1986:12). Needless to say, there is a big difference between being favorably impressed by a freely provided input and being willing to pay for that input at full market price. Respondents reported that under present market conditions they would find it difficult to continue the recommended practices without some form of subsidy or economic incentive.

As a first step, however, OPP may not have erred in providing free inputs to traditional farmers who are by and large skeptical of new and untried (at least to them) ways. The challenge now is to encourage farmers to continue using a technology that, although they clearly appreciate its beneficial effects, to this point has been cost-free. OPP staff recognize that a new arrangement must be devised, one in which producers share the cost of supplements and veterinary treatments with the project. Whether the arrangement is organized along

vouchering or some other lines, the crucial point is that farmers must eventually bear a larger portion of the true market cost of new inputs and treatments as these technologies gain increasing acceptance. This problem is not so serious when it comes to mineral supplements, however. At a price of Rp 250 (U.S. $.05) for mineral supplementation per month per farmers' group in 1986, participants found this technology a less risky investment (Amir et al. 1986:10). The case of drenching is more problematic, and points up the need for further research to tailor technology to the socioeconomic situation of smallholders.

LESSONS LEARNED

Perhaps the most important lesson the OPP staff has learned to date is that a technical solution to a problem is not necessarily a practical solution. Often, tested treatments are not commonly available in the market, or they utilize expensive raw materials, or they involve high fixed costs. It is essential that technology be screened through field experimentation not only for its technical soundness but also for its social and economic acceptability.

In spite of OPP ambitions, 11% of respondents to one survey said they felt it was too early to formulate an opinion of the ultimate value of the project (Amir et al. 1985). These farmers, at least, said that they would like to wait and see what OPP produces over time that is of use to them. Coupled with information from other analyses, this response pattern suggests that under current market conditions, farmers are unlikely to adopt all of the technology now being promoted by the OPP. This in no way impugns the inherent usefulness of the technology. Rather, it suggests that further research is needed on ways to develop more effective grassroots strategies that can disseminate these and other technologies at a price that the average stockowner can afford. In the future, research should focus on reducing the cost of the technology package (Amir et al. 1986:14–15).

Given the complexity of the typical Indonesian farming system and the marginality of many producers, change in one part of the system can have wide-ranging effects. Any recommendations from institutions such as BPT and BPV must be based on a thorough knowledge not only of the livestock component of the farming system but also the cropping component. Knowing how these components interact in terms of labor, purchased inputs, and income generation can help researchers find the best interventions. For example, while the intensive nature of rice cropping requires high labor inputs, using crop byproducts such as rice straw for small ruminant feed means that farmers can purchase fewer inputs for livestock production. Better breeding strategies make for more timely and profitable marketing and labor-use patterns. Interrelating the multiple needs of plants, animals, and people in such a way as to develop a more efficient overall farming system is what projects like the OPP are all about.

NOTES

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9

WOMEN, MEN, GOATS, AND BUREAUCRATS: THE SAMIA WOMEN'S DAIRY GOAT PROJECT[1]

Amanda Noble

In 1973 the U.S. Congress amended the Foreign Assistance Act of 1961 to recognize that "Women in developing countries play a significant role in economic production, family support and the overall development process" (U.S. Congress 1973:4, the "Percy Amendment"). The document also called for particular attention to activities "which tend to integrate women into the national economies of foreign countries, thus improving their status and assisting the total development effort" (ibid.). This led to policy changes within the U.S. Agency for International Development (USAID). In 1974 USAID mandated incorporation of a "conscious concern" for women in all programming processes—concept, design, review, implementation, and evaluation. Also in 1974, USAID established an Office for Women in Development (WID) charged with implementing Agency policy in this area and planning and carrying out activities in coordination with overseas missions (WID 1978). Coincidentally, the United Nations (UN) General Assembly proclaimed 1975 International Women's Year. It also designated 1976–1985 the Decade for Women, focusing on the themes of equality, development, and peace, and directing UN members to assess the economic position and progress of women in their countries

These events did not take place in a vacuum. They emerged from observations that most efforts to improve productivity in agricultural and other economic enterprises have been directed at men, despite the key role that women play in food production and commerce in many developing countries (DCs). Moreover, rapidly mounting evidence indicates that DC women bear a disproportionate share of the costs of economic development while men receive most of the benefits (Beneria 1981, Boserup 1970, Buvenič and Youssef 1980, Nelson

1981).[2] In part because of traditional gender divisions of labor in agriculture, many agricultural development projects have actually increased the burden of work for women, especially in sub-Saharan Africa. These observations and criticisms of development planning moved WID issues from the periphery to the center of development dialogue (Goddard 1985) and led to greater political and economic support for programs to help women in developing countries. One form this support took was the establishment of women-specific projects.

WOMEN-SPECIFIC DEVELOPMENT PROJECTS

The primary rationale for women-specific projects is to limit eligibility for benefits to women. The WID office contends that there is fundamental agreement within the development community "that the end goal [of any intervention] is full incorporation of women as equal partners in the development process," but that "in the short run, women-specific . . . projects are required" (1978:4). Many development experts in fact do agree with this assessment, arguing that such projects can offer the quickest, easiest, and often the most effective response to women's demands for programs (e.g., Tinker 1981). They base this argument in part on the structure of gender roles and stratification in DCs, claiming that there are many gender contexts in which it makes sense to consider such planning. Examples include the following (after Dixon 1980:10–11).

- When local cultural values proscribe public association between unrelated males and females.
- When girls and women need special programs to overcome past discrimination and help them "catch up" with men; e.g., in training for skills and professions previously closed to them.
- When women represent a high percentage of de facto household heads because of high rates of marital instability, widowhood, or male emigration.
- When in the prevailing division of labor, women specialize in tasks that could significantly benefit from assistance to increase their productivity and the returns to their labor (e.g., food production, stock raising, vegetable marketing).
- When men are likely to capture the returns to women's labor; for example, because men are the marketers of goods produced by women or because men, in their role as household heads, constitute the formal membership of cooperatives that nevertheless rely on women's work.
- When women desire activities of their own, such as revolving credit clubs or marketing associations, in order to achieve a measure of self-reliance or to avoid conflict and competition with men.

Despite these compelling arguments, there are drawbacks to women-specific projects (Buvenič 1986). For one thing, they are often isolated and plagued by communication problems. For another, they are invariably small because the bulk of development funds are channeled into "more important" initiatives. Even within WID, women-specific initiatives rank at the bottom of the list for funding priority. "Often designated 'shelf projects' . . . they wait on the shelf for fiscal year-end funding if bureaus are unable to move other money" (Staudt 1985:98). Moreover, among the few women-specific projects with economic aims that do win funding, most ultimately evolve into mere welfare action that delivers information, education, and handouts to poor women in their roles as wives and mothers.

There is a further dimension to the debate on women-specific projects. In a study of organizational behavior within USAID, Staudt (1985) found that the gender redistributive policy mandated by the Percy Amendment is in fact mediated by ethnocentric gender ideologies among male policymakers. In terms of Western notions of appropriate public and private spheres for each gender, male bureaucrats tend to interpret the channeling of resources directly to women as an intrusion upon family life and a threat to male authority. But as Staudt points out, these USAID bureaucrats' concept of a private family sphere may be inappropriate to many DCs, where women are more publicly active in agriculture, trade, wage labor, and the economic support of their families. Male bureaucrats have also raised questions about women-specific projects' causing marital separation and even community factionalism along gender lines. Of course, such questions "were unheard of for the numerous projects that included only men" (Staudt 1985:98). Male policymakers frequently argue that benefits from projects in which men participate will properly and naturally flow to women by virtue of their family membership.

In understanding the gender and policy implications of such perspectives, the concept of "resource dependency" is important (Pfeffer and Salancik 1978). No organization is completely self-contained. It is embedded in, and dependent upon the resources of, still other organizations. Organizations survive by meeting the demands of the various interest groups that support them. And these groups' gender ideologies have a direct impact upon the "success" of women-specific projects.

In sum, women-specific projects have been controversial from the outset. This chapter addresses the debate over such programs drawing upon nine months' research between July 1980 and March 1981 on the Samia Women's Dairy Goat Project (SWDGP), an effort aimed at an agropastoral area of Western Kenya. Here I argue that such projects can all too easily end up reproducing women's subordinate economic and social position, or even deepening their immiseration. Two factors contribute to this unfortunate process: indigenous gender roles and stratification that limit women's social and economic possibilities; and bureaucratic gender ideologies that define development planning

and practices at project sites and that shape policy in international development agencies.

The data presented here derive from three sources. First, structured, open-ended interviews were conducted with 71 women at four SWDGP sites. These interviews elicited general information on participants' and their husbands' work and decisionmaking patterns, along with more detailed data on the project itself. Second, 77 students of the three secondary schools in the project area were asked to write essays on the division of labor in domestic work, cropping, and especially stockraising at their homesteads. Third was participant observation and daily fieldnotes on the goat project and its members.[3]

THE SAMIA WOMEN'S DAIRY GOAT PROJECT

The Samia Women's Dairy Goat Project was begun in 1979, in the Samia location of Western Kenya's Busia District (Figure 10.1). The project had numerous sponsors, including: a woman member of Kenya's parliament; a private individual working with the Friends of the UN; the UNDP (UN Development Programme) Sheep and Goat Development Project, which assigned a fulltime technical assistant to train participants in goat husbandry; the Ford Foundation, which supplied funds for building materials; Heifer Project International; the Small Ruminant Collaborative Research Support Project (SR-CRSP), which was endeavoring to breed an improved, dual-purpose meat-and-milk goat; and UNICEF, which mobilized women at the SWDGP sites to adopt new village-level technologies like solar driers, mud stoves, and improved granaries.

The aim of the project was to introduce intensive husbandry of dairy goats to a region where animals were few but feed resources were plentiful. In the process, the SWDGP sought to fulfill two explicitly stated goals: to improve nutrition among rural Kenyan families, and to increase women's income. These goals were to be achieved by organizing women into *boma* production units in each of Samia's ten sublocations. "Boma" here refers both to the women's groups and to the goathouses around which they were formed. The latter consisted of screened-in quarters to protect the animals from insects like tsetse flies and ticks. This kind of intensive, confinement system of animal husbandry represents a departure from traditional Kenyan techniques, in which goats are herded or tethered.

The SWDGP hoped to build one boma, designed to hold about 70 animals, for each of Samia's ten sublocations. By 1981 eight bomas had been constructed. Boma membership ranged from approximately 30 to 50. The formation of women's organizations was not new to SWDGP members; 79% of interviewees also belonged to one or more other women's groups.[4] To join the SWDGP, women paid Ksh 5 (less than U.S. $1.00), and each boma elected its own officials: a chair, vice-chair, secretary, vice-secretary, and treasurer. In addition, the project hired a watchman and a herder, both male, at each boma.

Group meetings were held weekly, bimonthly, or monthly to deal with the general care of the project goats and with boma management. The organization of labor was a major issue at most meetings. Attendees would be assigned tasks to perform until the group met again—e.g., fetching water, providing forage, cleaning animal quarters, or milking. In some bomas, money was collected to pay the workers; but in others, women received no pay. Meetings also served as an occasion to discuss personal problems and other matters. Thus the groups had informal as well as formal functions and spanned both public and private domains.

Among the four bomas studied, one was stocked with Anglo-Nubian goats, another with Toggenburgs, and the remaining two with the indigenous Small East African goat. The European breeds were managed under a zero grazing system, with cut-and-carry forage brought to the penned animals. The bomas stocked with indigenous goats relied upon more traditional herding and tethering methods.

At one boma, crossbreeding was underway in an effort to produce a disease-resistant dairy animal. Organizers promised sufficient production of crossbred animals so as to give all SWDGP members a few for household use. This distribution scheme was elaborated with several aims in mind: to entice women to join the bomas; to convince their husbands that, in the long run, the men would profit from the immediate loss of labor that their wives' participation would entail; and to keep morale high despite slow progress. Along with the original purebred dairy goats, any surplus crossbreeds were to remain in the bomas under the management of the women's groups. Decisions about the sale of these goats and distribution of the earnings were to be made jointly by the members. Project sponsors planned for the crossbred goats to be marketed locally. Earnings from sales of the first offspring were earmarked to fund construction of subsequent bomas. The second offspring and/or income from their sale were to be managed by participants. In reality, however, project sponsors instead moved the second offspring to newly established bomas in other sublocations. This postponed production of enough crossbred goats for the first participants' household use far into the future.

In any case, the price of constructing household bomas to stable three or four crossbred goats proved prohibitive. The group bomas cost approximately Ksh 18,000 or U.S. $2500 apiece to build, due to the high price of screening material, corrugated tin roofs, water tanks, and imported lumber. Experiments with household-sized bomas yielded a structure that cost approximately Ksh 200 or U.S. $20.00. While not excessive, this sum was beyond the means of most families. Although loans might be arranged, most people felt it would be too risky to invest so much money in exotic animals with unfamiliar and complex husbandry requirements, plus as-yet-uncertain characteristics and returns.

Although an ultimate SWDGP goal was project self-sufficiency, the sponsorship created dependency on external resources from the outset. Moreover,

the sponsors' unilateral decision to move animals to other bomas raised questions in some minds about who really controlled the project—participants or outsiders? This brief overview of the SWDGP sets the stage for analysis of project dynamics in terms of gender roles, stratification, and ideologies.

GENDER ROLES AND STRATIFICATION IN SAMIA

In many societies goats are, like poultry, a "women's animal" (Beaman 1983, Cloud 1977, Henderson 1980, Martin and Voorhies 1975). Moreover, when men emigrate, women's responsibility for livestock generally increases (LeVine 1966). In such circumstances, livestock projects for women may well seem logical. However, gender divisions of labor in Samia militate against this logic. Traditionally, men and boys tended goats and cattle, and men were responsible for physical maintenance of the homestead and for most trading activities. Women and girls carried out the bulk of cultivation tasks, especially hoeing. (For cultural contrast, see Fernández or McCorkle this volume.) Women also cooked, fetched water and firewood, gathered wild foods, and processed food-grains. Men and children joined the women in planting, weeding, and harvesting (after Wagner 1939).

These traditional role definitions remain little changed, even in the face of major socioeconomic shifts that have forced rural men throughout Kenya to emigrate for wage work (Mbabu this volume), leaving their wives behind as *de facto* household heads. Reliable estimates place the number of female-headed households in Western Kenya at about 40% (Moock 1976, Staudt 1976). Among the 71 SWDGP participants surveyed, 31% of their husbands were working outside Samia during the interview period. Moreover, the husbands of 84% had a history of emigrant wage labor; and over half the interviewees listed waged work as their husband's principal occupation, rather than farming (38%) or fishing (6%). Nevertheless, males retain strong authority over livestock. This is clearly evidenced in both the essay and the interview data collected during field research in Samia.

Gender Roles in Livestock Labor and Decisionmaking

Student essays on the gender division of labor in their homesteads unequivocally asserted that women are not responsible for the family ruminants in Samia. Ninety-two percent of the 77 essayists indicated that the only livestock cared for by a female at their homestead is chickens. Some students explained this by the fact that at night chickens are housed in the kitchen, the domain *par excellence* of women. Other students did not associate any one gender or household member with poultry raising. Instead, they wrote that their family's hens "look after themselves," thus disavowing the importance, or even the

existence, of any labor linked to poultry raising. Moreover, many students noted that their fathers decide on the slaughtering of chickens for ceremonies or guests.

With very few exceptions, management of ruminants was cited as the male head of household's domain, with considerable assistance from sons. As one female student put it, "The care of animals as we know very well, a female type of person cannot do this job." Again and again the essays stated that fathers and sons care for sheep, goats, and cattle. They, not women and girls, are ideally responsible for grazing, selling, and slaughtering these animals.[5]

A number of essayists also addressed changes that occur when fathers are absent or deceased. Many indicated that their mothers then become the "household leader" and the "farmer" of the family. However, such observations were often qualified with statements like "When my elder brothers are around, they normally become the household leaders" or "[Although] On my father's absence, the household is looked upon by my mother, . . . when he's around, he's the one who roars." Such responses imply that while a woman may take functional charge of the household in her husband's absence, this may not reflect a real change in roles. The facts that older sons are consulted and that fathers return to "roar" suggest that female control is tenuous at best.

Furthermore, if women in such households were in actual control of livestock one would expect animal husbandry chores to be part of the normal ensocialization process for girls. But none of the women interviewed said anything about their daughters' helping out with pastoral work. They cited only traditional female tasks. These center on agricultural and culinary chores: hoeing, weeding, fetching wood and water, grinding grain, and cooking. Coupled with the essay data, this finding suggests that while role behavior may be changing out of necessity, role definitions and ensocialization patterns are not.

Possibly because of bias from the presence of a female researcher and/or from the research topic itself (a women's livestock project), interviewees presented a somewhat less traditional view of women's roles in animal husbandry than did essayists.[6] Forty-six percent of the 71 SWDGP respondents indicated that care of the family goats is either a man's job or a shared responsibility. However, 24% said it is a woman's job; and another 24% answered that it is a man's responsibility but that, for various reasons, women do the work (Table 9.1). All but one respondent explained this as a result of men's absence from the homestead, whether working elsewhere or just "not around." As one interviewee summed up, "Women care for goats when men are away. They [women] are supposed to do everything."

The women's responses about economic decisionmaking with respect to livestock were more traditional. A majority indicated that it is the husband's decision to sell (63%) or slaughter (69%) animals, although a majority (58%) also felt that the wife would make all such decisions if her husband were absent (Table 9.1). Still, 21% indicated that she would do so with the help of a male relative or neighbor; and another 21% said she would have to contact her

TABLE 9.1 INTERVIEWEE REPORTS OF GOAT MANAGEMENT AND LIVESTOCK DECISIONING

QUERY AND RESPONSE	PERCENT RESPONSES (n = 71)
Who is responsible for managing goats?	
Women	24
Men	13
Both – a shared job	34
Men; but women sometimes do it	24
Children	5
Who decides when to sell livestock?[a]	
Men	63
Women	0
Both – shared	37
Who decides to slaughter?[a]	
Men	69
Women	0
Both – shared	31
Who makes these decisions when husband is absent?[a]	
Wife alone	58
Wife with advice from male relatives/neighbor	21
Wife with permission from husband	21

[a]Includes cattle and sheep as well as goats.

husband first. However, participant observation revealed behaviors suggesting that some of these claims may be overblown. During fieldwork, frequent visits were made to a weekly livestock market in Samia. On only one occasion was a woman ever observed selling a goat. When questioned, she explained that she had written to her husband "begging his permission to sell the goat to help with school fees." In contrast, women as well as men were regularly seen selling chickens. It is also noteworthy that chickens are sold in a different part of the market, thus underscoring goats' status as a category of livestock apart from poultry and other "female" crops.

Male Authority Within the Family

A broader issue, but one closely linked to the gender division of agropastoral labor, is the distribution of power and decisionmaking responsibility within Samia families generally. In this regard, student essays repeatedly emphasized traditional male authority. Indeed, a number of essays went well beyond simple assertions of sex role norms to declarations of patriarchal hegemony like the following.

- I stand to say that the powers and privileges inherent in my father are unmistakably sacrosanct . . . He is the sole maker of the home and it entirely rests upon him to defend it in economic, social, and political issues. He fences, builds granaries, disciplines us. In case of misfortune, he makes offering to the living dead . . . Mother cares for children, cooks, fetches water and firewood assisted by daughters as we sons regard this as an affront to us.
- My father is the household leader who takes care of all economic activities in the home. He gives out money where there is a need to buy foodstuffs, paraffin, or clothes. Mother is responsible for the well-being of all the family. She cooks food and maintains discipline among children and reports to father for punishment. Father is in turn responsible for their discipline.

These and many other, similar statements (Noble 1985, Noble and Nolan 1983) reflect a pervasive ideology of male dominance within the Samia family. The father is held in high esteem and wields final authority within the household. In the chain of command, discipline, and punishment, he has the last word. Moreover, male dominance is linked to work roles in that women's chores are considered an "affront" to males. Finally, the household economy is under the father's control. Although women do most of the work of foodcrop production and marketing, men control any financial gain from this labor.

In sum, despite real changes in the division of labor due to male migration, Samia gender-role ideals and ensocialization patterns still give males primary rights to animals and ultimate household authority. These social, cultural, and economic realities made it unlikely that benefits from a women-specific livestock project would in fact be limited to women. So did project actions that reinforced this social order.

GENDER ROLES AND IDEOLOGIES IN THE ORGANIZATIONAL ENVIRONMENT

As noted earlier, sponsorship of the SWDGP was a complex and confusing amalgam of seven national, international, individual, or organizational actors. This diversity of sponsors gave the SWDGP a very public image. Representatives of various countries and interests made many visits to the bomas. Given advance notice of visitors, project staff would round up women to be present and answer questions. Indeed, one boma became designated the "showcase" site. The closest to a major road, it boasted European goats that gave high milk yields, the most extensive display of village technology, and an experimental plot of fodder crops. On one occasion when the President of Kenya was expected to visit, all the fenceposts were brightly painted in the colors of the national flag. The transformation of this boma into a display site illustrates how environments

affect and even alter organizations. Here was the place to take present and potential sponsors in order to assert organizational effectiveness.

Of course, each sponsor had its own interests and hence different criteria by which to measure project effectiveness. These interests spanned new technology, crossbred goats, milk and forage production, and the roles of rural women. More to the point here, however, the organizational environment and gender ideology of the major sponsors worked to subvert the goal of income generation for women.

Male Herders

As noted earlier, a herder and a watchman were hired in salaried positions at each boma. Both were men. This was understandable in the case of the watchmen because it was considered dangerous and socially unacceptable for women to stay out overnight. The case for male herders was less clear, however. If indeed herders were required, such as at the bomas stocked with Small East African goats raised under traditional grazing and tethering patterns, then why weren't women hired? And at bomas employing zero grazing systems, why were herders needed at all? Most important, what was the rationale for hiring men on a putatively women-specific project?

The answers to these questions are complex. According to informants, the selection of hirees of either gender was in part related to the ownership of the land used for the bomas. Usually private rather than trust land (i.e., communal land administered through chiefs and subchiefs) was donated for project use. Usually, too, at least one employee at each boma was a relative of the former landowner. Of course, males own nearly all the privately held land in Samia. Still, this does not fully explain why male herders were hired on a women's project. Part of the reason for this move is that it accommodated traditional gender ideals of livestock labor wherein males, not females, do the herding. Similarly, employing males in this salaried position reproduced wage-work patterns in the larger society, where it is men who typically work for wages. Among the women interviewed on the SWDGP, for example, only 5% had ever done any wage work, and only about half had ever conducted any form of cash-based trade. In contrast, 56% of their husbands were currently engaged in wage labor.

The gender ideologies held by SWDGP developers further legitimized this division of labor on the project. The UNDP technical assistant (a male) "explained" the hiring of men as follows: "There are ten casual staff who help in herding and watching the animals during the night and such duties women cannot afford to carry out . . . Therefore, men were employed to carry out such duties in the normal way" (Okoth 1980:14). Why women cannot "afford" to carry out these duties is not made clear in this document, however. Note, too, that this male technical assistant made the final decision on what kinds of

employees were needed and on whom to hire. In sum, one of the women-specific goals of the project—income generation for women—was obscured by the presence of salaried male employees.

The Technical Sponsor

As technical sponsor of the SWDGP, the UNDP's interests centered on basic husbandry concerns such as breeding, milk production, animal disease, and herd losses. Social issues, like who contributed labor and who earned salaries, received attention only when problems in these areas spilled over into production. The UNDP did seem to perceive the SWDGP as a "women in development" effort, and it considered this important insofar as women's projects were popular with international development agencies. But as summarized in its 1980 annual progress report, the UNDP saw the SWDGP's primary goals as:

> . . . developing and improving small ruminants which have been forgotten for so many years. The aim of the project was not to compete with dairy cattle . . . but only to fulfill the gaps which have been left vacant by dairy cows in the area, such as shortages of meat and milk which are sources of protein (Okoth 1980:1).

Visibly missing from this description is any mention of the goal of economic development for rural women.

With regard to the UNDP's mandate to train participants in goat husbandry, the same report claims that "The women came for practicals [training in drenching, dipping for ticks, spraying, hoof trimming, milking, etc.] once a week. This is because they have some other duties to be done at home so they could not come throughout the week like any other permanent employees" (Okoth 1980:14). Throughout the nine months of the author's field research, however, there was no evidence of regular (much less weekly) "practicals." On only one occasion were women informed in advance of a training session, and they did not show up at the stipulated time, likely because the session was scheduled during the morning hours when they work in the fields.

In any case, it would have been physically impossible for the one UNDP technical assistant to train women weekly at the eight, geographically dispersed locales. Consequently, the men in salaried SWDGP positions at each boma were instead trained and made responsible for in turn instructing the women—although they never did. However, their putative training function perhaps helps explain the presence of "herders" in bomas where there was no herding to be done. In effect, these men, who received the actual training, became the de facto managers of the "women's" goat project.

The Ideological Sponsor

Dr. Julia Ojiambo, a member of the Kenyan parliament, was the ideological sponsor of the SWDGP. As one of Kenya's leading spokespersons for rural women, Ojiambo enjoys both national and international acclaim for her championing of health, crafting, marketing, literacy, agricultural, and rural women's programs in Samia (Binge 1979:1). She was the major actor in planning the project, obtaining initial funding, negotiating with development agencies, and mobilizing women's labor for the project. In fact, Ojiambo's sponsorship of the SWDGP was one of the primary reasons behind many participants' decision to join the project (Table 9.2). The women's allegiance to Ojiambo and their belief in her sincere commitment to development likewise contributed to their continued participation despite slow progress on the SWDGP and confusion about its ultimate goals. As interviewees noted:

- Dr. Julia has brought *maendeleo* [KiSwahili for 'development' or 'progress'] for the old women. I'll be in groups until my death. Dr. Julia has brought a gift from God.
- I joined . . . because when Dr. Julia got the seat in parliament, the women were happy. Then the women were given a seat in agriculture because we now have goats. I am very happy. The women have strength; they are above the men. A man had the seat before Dr. Julia. He never brought such a good thing to our district.
- I joined . . . because . . . Dr. Julia . . . was telling us that she was bringing goats. My strength here continues on that promise.

But does Ojiambo believe in limiting the benefits of development projects to women? While she clearly feels that women should be trained and urged to establish income-generating projects (Huston 1979), she rejects the idea that women may have development needs or concerns of their own, apart from men's. In an article in the *Daily Nation*, she is quoted as saying:

> I wonder who these women are that are up in arms against Kenyan men . . . Every community has got a few disgruntled women, and Kenyan women must not abuse their genuine participation in national affairs . . . I feel there should be no forum for women alone, just as there should be no forum for men alone. Any forums for women's discussions should be aimed at discussing family problems. There should be nothing like women's issues. Such issues affect the whole society and they are family issues touching man and child (Munyakho 1980:18).

Clearly, Ojiambo sees the advancement of women and their heightened participation in the development process as intimately related to increased opportunities for families rather than for individual women. Her vision of the SWDGP's future was that eventually the bomas would become major subloca-

TABLE 9.2 INTERVIEWEE REASONS FOR JOINING SWDGP

REASON CITED	PERCENT RESPONSES (n=71)[a]
Maendeleo, political allegiance	45
Obtain goats for household	25
Learn from others, exchange ideas	37
Curiosity, be with others	37
Social security of belonging to a group	14

[a]Multiple responses allowed.

tion centers where—aside from the goat and village technology projects—meetings would be held, markets built, and social events mounted. All these activities would involve both men and women. She felt that if men spent more time at the bomas, they would lend their wives more support in their development efforts and that men, too, would thus have more opportunity to participate (Ojiambo 1981). For her, having salaried male employees at the bomas was non-problematic. Instead, this conformed to her views on the inseparability of men's and women's best interests.

In summary, the SWDGP's complex organizational environment negatively impacted its women-specific goals. The sheer number of sponsors and their disparate interests diverted attention from what one high-ranking Kenyan official termed "the strange [i.e., supposedly female] management of the project" and the aim of income generation for women. Moreover, the project's ideological sponsor did not support the concept of targeting benefits to women. Neither did the technical sponsor, who was charged with training women so they could eventually manage the goats autonomously. Instead, men were hired and trained; and this decision went unquestioned by those who planned the SWDPG as a women-specific project. Not surprisingly, participants began to experience numerous misgivings about "their" project.

DISCUSSION AND ANALYSIS

Aside from their political allegiance to Ojiambo, women enunciated two broad reasons for joining the SWDGP (Table 9.2). One, of course, was the hope of economic gains from eventual goat ownership (cited by 25% of interviewees). The other consisted of a variety of perceived social and/or educational benefits (Table 9.2). Some of the social benefits presumably were realized. But are they enough to qualify the project as a success? Certainly, from the UNDP's point of view, the project was counted a technical success. It lost very few animals and showed a financial gain from milk sales. And although

the crossbreeding was in an early stage, relatively few problems had been encountered.

But what about the proposed economic benefits to women? Recalling Dixon's list of conditions justifying women-specific projects, it is clear that at least three of these hold for Samia. First, women represent a high percentage of *de facto* household heads. Second, men are likely to reap the returns to women's labor. Third, women who head households engaging in small ruminant production clearly could benefit from assistance to increase their productivity and the returns to their labor. Any or all of these conditions might have paved the way for a successful women-specific project. Yet across the two-plus years of its existence documented here, the SWDGP never produced any clear economic benefits for participants. Worse still, a majority of interviewees (54%) reported that it interfered with other tasks, including housework (34%), cropping (10%), and trading (10%). The only individuals who directly benefited economically were the male employees. Their labor was attached to a wage, not a promise. Women did not even acquire any new skills or knowledge, thanks to the technical sponsor's rationalization of the need to accomplish work "in the normal way." Only men received training in dairy-goat management, training that was originally promised to women.

Neither were the benefits promised to families forthcoming. The household distribution scheme was indefinitely delayed by the project's decision to move crossbred offspring to other bomas. In any case, the scheme would have meant more work for women at home—work that likely would not have directly benefited them. Placing goats in a family context where males dominate livestock decisionmaking and hold final authority over the household economy would effectively block women's control of the animals. Recall that the household distribution scheme came into being in large part to assure husbands that they would eventually profit from their wives' participation in the project. A goat for every household really meant a goat for every husband.

Here lies the core of the SWDGP's problems. From the outset the goat project was *not* entirely a women-specific effort. Rather, it had two, competing goals: improved health and nutrition for *families* and income generation for *women*. The former was considered at least as important as the latter.

Organizational ideologies and practices further obscured the goal of income generation for women. The SWDGP's ideological sponsor emphatically believed in the inseparability of men's, women's, and families' best interests. Her notion of women's income translated to family income. Here, the contextual meaning of "family" is important. Kenyatta's description of Kenyan patriarchal families holds for Samia as well as for the nation as a whole.

> The father is the supreme ruler of the homestead. He is the owner of practically everything, or in other words, he is the custodian of the family property. He is respected and obeyed by all the members of his family group (Kenyatta 1938:9).

In such contexts, a family-oriented project would not necessarily benefit women. More likely, men would control any benefits at the household level, where men have "supreme" authority over labor and its returns, even when women act as *de facto* heads.

As we have seen, the ideological sponsor was also concerned about threats to male authority. As Staudt (1985) has documented, this concern is shared by many USAID bureaucrats. Yet worries about the intrusion of women-specific projects into the private family sphere may be inappropriate for many developing nations where women have larger public roles. At first glance, this would seem to be the case in Kenya. Approximately 88% of the female population resides in rural areas, where almost all adult women farm their own smallholdings and produce much of their families' food. In nearly a fourth of all rural households, the husband is either deceased or absent for long periods (Central Bureau of Statistics 1977), leading females to assume much of the work normally done by men. Still, the concept of "public" is problematic. While certainly rural Kenyan women engage in many non-domestic activities (e.g., hoeing, weeding, harvesting, storing and processing grains, poultry raising), they nevertheless live in households where they have virtually no control over returns to their labor, even when acting as *de facto* heads. Moreover, Samia women rarely participate in trade or wage work.

All these factors contributed to the difficulty of limiting SWDGP benefits to women. Ultimately, participants' ownership and management of the project was mediated both by the existing gender order in Western Kenya and by the ideologies and practices of project organizers and agencies. These factors all worked to effectively counter the threat of redistribution within the family sphere. The conditions that some authors argue legitimize the circumscription of benefits to women were never mitigated.

CONCLUSIONS AND POLICY IMPLICATIONS

A central problem of the SWDGP was its mix of family and women-specific goals. This is illustrative of a common belief among experts and bureaucrats from developed and developing nations alike that these two populations—families and women—are inseparable. Hence the argument for integrated projects. But counter-arguments for women-specific initiatives indicate that there is good reason to distinguish these groups. Recall that the overarching criticism leading to the Percy Amendment and creation of the WID office in USAID was that, with development, women lose and men gain. In the past, agricultural development efforts have ignored women—the "invisible farmers"—and their vital economic roles in cropping and stockraising. As a result, on orthodox "integrated" projects, men have gained new knowledge, status, and real economic benefits, while women have reaped only added work. Thus the need for women-specific projects.

To date, however, such projects have been plagued by problems. Underfunded, small, isolated, and vouchsafed little importance, they have often devolved into welfare action directed at women as wives and mothers, not as productive agricultural or pastoral workers. One reason women-specific projects suffer such problems is that they represent the most radical course in gender redistribution planning. They openly challenge idealized family concepts of males as providers and females as dependents. This has led some analysts to conclude that "Gender issues have more mileage when submerged in development sectors such as water, forestry and agriculture" (Staudt 1985:107). I add dairy goats to this list.

Analysis of the SWDGP throws into relief the drawbacks of *both* integrated and women-specific projects. The SWDGP's family objectives are characteristic of the former. Had the family boma plan been realized, it would have meant more work for women in a household context where men dominate livestock decisionmaking. As for the women-specific objective, this was characteristically stymied by project sponsors' adherence to indigenous gender roles and stratification patterns, and by gender ideologies that shape planning and policy at international as well as national and local levels. In truth, none of the sponsors viewed the SWDGP as a women-specific project.

The displacement of the SWDGP's women-specific objectives by "family" goals does not mean that all such endeavors are necessarily destined to fail. However, it does point up some important lessons. One is that gender ideologies are profoundly entrenched and that the notion of limiting benefits to women is a very controversial one. Women-specific projects are probably far more radical than policymakers realize. Planning and implementing such initiatives is correspondingly problematic. The larger lesson is that a great deal remains to be learned about how to incorporate a "conscious concern for women" into agricultural development programs and policies. If the SWDGP is representative of projects specifically designed to aid women economically, what can we anticipate from projects in which women are *not* explicitly considered? According to Tinker (1981), the answer is: a reversion to earlier patterns of ignoring women altogether.

Despite the many shortcomings of women-specific projects, the rationale behind them cannot be dismissed. Opting for orthodox integrated projects only reinforces ideologies and family structures that promote inequality between men and women. I suggest that women-specific projects can offer much-needed insights into how to build a workable "conscious concern" for women into development. However, such projects must be adequately funded and their progress carefully monitored and studied. Certainly, going from invisible to visible is not easy, and there is much for all of us—women, men, and bureaucrats, anyway—to learn along the way.

NOTES

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2. Some innovations (e.g., improved water supplies, health care, roads) doubtless made life easier for all, although still perhaps differentially for males and females.

3. For details on informant populations and data collection procedures, see Noble 1985 or Noble and Nolan 1983.

4. Thirty-seven percent were members of associations that farmed for money; another 40% belonged to workgroups that typically consisted of clan members who exchanged agricultural labor. Other memberships included: church farming groups that produce food to give to landless poor families (14%); church clubs that aid women in times of illness or birth (13%); fishing and village technology development groups (10% each); brewer associations (21%); and dancing (3%), family planning (1%), and beekeeping groups (1%).

5. Milking was less clear-cut. A few students mentioned that their mothers do the milking; one noted that his mother sells some of the milk and keeps the revenue. However, a much larger number attributed milking and milk sales to males.

6. The essays' emphasis on traditional roles may be partly due to the students' stage of psychological development. In the U.S. and Europe, children of this same age group are more concerned with conformity to sex role norms than is the larger population (Maccoby and Jacklin 1974). Similarly, a 1984 study in Kenya found that essays by secondary school children were useful sources of information on sex role expectations in that "Secondary school children are often the repositories of their societies' highest aspirations and values, as yet undimmed by reality" (Buzzard 1984:276). The truth probably lies somewhere in between the women's responses and the traditional values enunciated by the students.

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10

POPULATION PRESSURE AND CHANGING AGROPASTORAL MANAGEMENT STRATEGIES IN WESTERN KENYA[1]

W. Thomas Conelly

Intense population pressure in Western Kenya has profoundly affected the way farmers manage their land and labor resources. Increasing population densities since early in the century have led to the steady intensification of cropping systems, as the amount of land available to farm families has dwindled with each generation. In much of the region, fallow periods have been reduced or even eliminated. At the same time, erosion control, fertilizers, new seed varieties, and more labor-intensive cultivars such as coffee and tea have been adopted in an effort to increase land productivity and profitability. This relationship between population pressure and intensified cultivation practices is not unique to Western Kenya; it is well documented in the anthropological literature for many other parts of the tropics. In contrast, with only a few exceptions (e.g., Allan 1965, FAO 1983, Netting 1968, Ruthenberg 1968 and 1976), the effect of population pressure on livestock management is less well understood, as is the important role that livestock often play in maintaining intensive farming systems.

Western Kenya provides an apt example of how population density impacts livestock management strategies and how changes in animal production systems influence successful crop cultivation. This chapter compares the organization of livestock production in two areas of Western Kenya—one with a moderate population density and a semi-intensive livestock management system, the other with a very high population density and an intensive system that emphasizes integrated food/feed crop production. This comparison demonstrates that population pressure has led to a number of important modifications in Western Kenyan agropastoralism.[2] These include changes in the management practices

employed by farmers in caring for their livestock, the amount and type of labor allocated to plant and animal domesticates, women's contribution to the care of livestock, the interactions between agro- and "pastoral" enterprises, and the role of livestock products in the diet. These changes are examined in detail, along with their implications for agricultural and livestock development policy, the status of women, and the adequacy of household nutrition.

THE RESEARCH SETTING

Research was conducted in two communities of Western Kenya, in a region noted for its abundant rainfall, high agricultural potential, and rapid population growth (Figure 10.1). Masumbi, an ethnic Luo community in Siaya District, lies in a medium-potential farming zone that has an average annual rainfall of 1125 mm distributed over two cropping seasons (Table 10.1). Its population density is about 200/km (Central Bureau of Statistics 1981); landholdings average 2.5 ha per household, with 1.2 ha devoted to foodcrops during the main agricultural season. The farming system is based on a maize and bean intercrop supplemented by sorghum, cassava, and bananas. Few farmers have adopted modern inputs such as chemical fertilizers or hybrid maize seed. As a result, yields are low, with estimates of maize production in a maize-bean intercrop ranging from 1000 to 2000 kg/ha (Jaetzold and Schmidt 1982, Sands 1983).

Cash cropping is not important in Masumbi. Only a few farmers cultivate small plots of coffee, cotton, or sugar cane. There is some marketplace sale of foodcrops, particularly cassava and beans in years when plentiful rainfall makes for high production. Livestock, which are raised for sale and milk, are an important component in the farming system, although herd sizes have been decreasing in recent decades. Household herds average 4.3 head of cattle, 1.4 goats, and 0.9 sheep. Off-farm income from both local and migrant labor is a critical supplement to farm production for some families. In 30% of Masumbi households, women manage the farm in the absence of their husbands, who are deceased or working off-farm.

Hamisi, an ethnic Luhya community in Kakamega District, is located in a high-potential farming zone with an average annual rainfall of 1725 mm (Table 10.1). It has one of the highest population densities in rural Africa—over 700/km^2 (Central Bureau of Statistics 1981). Farms average only 1.3 ha per household (0.17 ha/person), and more than 40% of households own less than 1.0 ha. As in Masumbi, intercropped maize and beans are the subsistence staples; sorghum, sweet potatoes, bananas, and vegetables are also important. But many Hamisi farmers use small amounts of chemical fertilizer on their fields, and many have adopted hybrid maize (Table 9.1). Foodcrops are planted on about 50% of the land area, and maize yields are estimated at 2000 to 2500 kg/ha (Jaetzold and Schmidt 1982, Sands 1983).

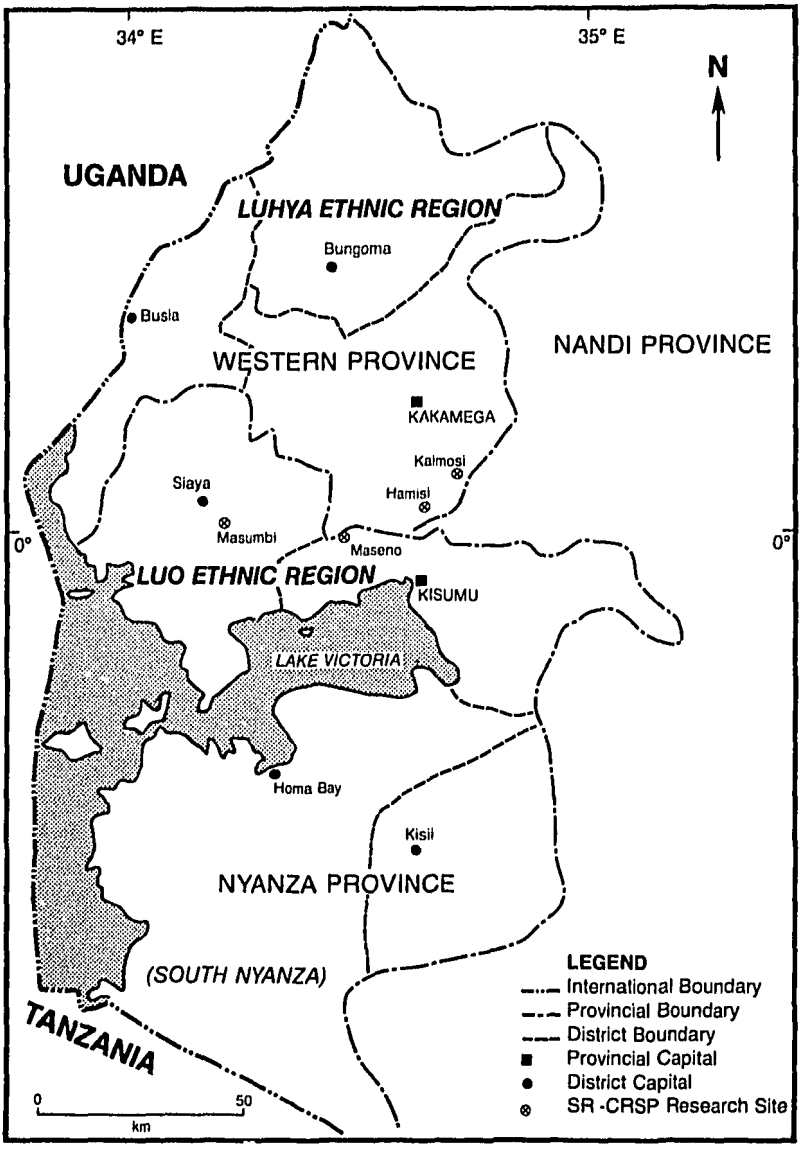

FIGURE 10.1 WESTERN KENYA

TABLE 10.1 FARMING SYSTEMS IN MASUMBI AND HAMISI

VARIABLE	MASUMBI	HAMISI
Rainfall	Medium (1125 mm/yr)	High (1725 mm/yr)
Population	Medium (200/km^2)	Very high (700+/km^2)
Land size	Medium (2.5 ha/hh)	Low (1.3 ha/hh)
Food crops	Maize, beans, sorghum, cassava (1.2 ha/hh)	Maize, beans, sorghum, sweet potato (.6 ha/hh)
Farm inputs	Low fertilizer and hybrid seed	Medium-high fertilizer and hybrid seed
Cash crops	Little cotton, coffee, sugar cane (.05 ha/hh)	Much tea, coffee, and eucalyptus (.27 ha/hh)
Livestock	6.5 animals and 1.2 ha fallow land/hh	3.1 animals and .3 ha fallow land/hh
Off-farm labor	Medium (30% female farm managers)	High (54% female farm managers)

[a]Farm data are based on interviews of 24 randomly selected households (hh) in each community. Land area estimates are based on actual measurement of parcels.

Cash cropping is of major importance in Hamisi. Approximately 25% of the land is devoted to smallscale production of tea, coffee, French beans, and eucalyptus trees. Livestock remain an important smallscale enterprise, with herds averaging 2.5 cattle and 0.6 small ruminants per household. Off-farm labor is an essential complement to farm production. A majority of Hamisi's young men work at salaried employment, either locally or as migrant laborers. More than 50% of Hamisi households have a female farm manager, in the absence of husbands working off-farm.[3]

POPULATION AND CHANGES IN LIVESTOCK PRODUCTIVITY AND MANAGEMENT

In recent decades, herds have progressively declined in Western Kenya because of population increase and the resulting decrease in grazing lands. This decline has been especially pronounced in communities like Masumbi. A 1944 cattle census carried out by the Veterinary Department in the vicinity of Masumbi found an average herd size of 18 animals per household (KNA/DC/KSM/1/34/14).[4] This figure is four times greater than Masumbi farmers' current mean holdings of 4.3 cattle per household.

Population densities in southern Kakamega District have been high since the first years of British rule in Western Kenya. Based on "hut" counts carried out

to assess taxes, in 1923 the area that today comprises Vihiga and Hamisi Divisions already had a population density of about 300/km^2 (KNA/DC/NN/1/1). By 1979, this figure had risen still higher, to 650–1000/km^2. The population of Hamisi sublocation, the focus of this study, increased from approximately 135/km^2 to 700/km^2 during this same period.[5] Historical records indicate that, even as early as the 1930s, cattle herds were quite small in southern Kakamega. Moreover, a number of intensive management techniques, including tethering and cut-and-carry feeding, had already been adopted (KNA/AGRI/NK/1948, Wagner 1956).

In both Masumbi and Hamisi, villagers report that along with herd size, milk production has also dropped significantly. Informants explicitly tie both these changes to population increase and the steady loss of grazing land over the years. They also note that government programs to demarcate land and to grant individual tenure (Mbabu this volume) have greatly impacted their livestock production systems. These programs, completed by the mid-1970s, have made it difficult to maintain large and productive cattle herds, especially for farmers who own little land. In Masumbi, for example, in the past livestock could graze freely on common pastures or on any fallow land within the community. Today, however, fallow land and the few remaining grazing grounds are all privatized (see also Guillet this volume). Moreover, most landholders do not allow other's stock on their property, except by prior agreement with close relatives or friends.

Allocation of Livestock Labor

In response to declines in grazing land, farmers have shifted their husbandry practices from tethering and herding on communal and fallow land, to tethering in the household compound and cut-and-carry feeding. A yearlong (1986–1987) livestock management survey[6] conducted by the SR-CRSP showed that these shifts are much more pronounced in Hamisi. During the survey, Hamisi livestock were usually found tethered in the compound; feeds such as maize thinnings were provided for the animals in about 30% of the observations (Conelly et al. 1987). In Masumbi, however, animals more frequently roamed loose or were herded; they spent more of the day grazing and browsing on fallow land or pastures away from the compound;[7] and cut-and-carry feeding was much less common (Table 10.2).

Table 10.3 provides a breakdown of livestock labor by task for the two communities. These data clearly depict the changes induced by intensification. In the semi-intensive system of Masumbi, over 75% of all work was accounted for by tethering and herding. In contrast, over 70% of all time allocated to livestock management in Hamisi involved the production and provision of cut-and-carry feeds.

Another consequence of intensification has been an increase in the total amount of labor devoted to livestock care. This primarily results from the labor

TABLE 10.2 LIVESTOCK MANAGEMENT PRACTICES BY COMMUNITY[a]

PRACTICE	MASUMBI (n=10468) Smallstock	MASUMBI (n=10468) Cattle	HAMISI (n=10628) Smallstock	HAMISI (n=10628) Cattle
Location of Animals				
Compound	52.0	54.0	62.5	77.3
Fallow field	25.4	35.7	32.0	17.9
House or boma	22.5[b]	10.2	5.5	4.7
Control of Animals				
Tethered	69.1	69.5	99.1	97.6
Loose/herded	30.9	30.5	0.9	2.4
Feeding of Animals				
Cut-and-carry feed provided	6.2[c]	1.3	29.5[c]	39.4

[a]Percent of total observations, 1986-1987.
[b]Masumbi farmers often do not let their livestock out of the house or boma (corral) to graze until mid-morning because they believe dew is harmful to the animals.
[c]Most smallstock cut-and-carry feeds are given to goats.

TABLE 10.3 LIVESTOCK LABOR BY TASK[a]

TASK	MASUMBI (n=504)	HAMISI (n=392)
Cut-and-carry feeds	3.7	18.4
Feed-crop production[b]	—	54.3
Tethering/checking	37.1	4.6
Herding[c]	38.7	10.6
Milking	6.4	2.6
Providing water	4.2	7.4
Other	9.9	2.1
Total	100.0	100.0

[a]Percent of all livestock labor.
[b]Calculated as one-third of all labor in Hamisi allocated to production of food crops that are also important sources of animal feed (e.g. maize, sweet potato; see Table 10.6).
[c]This task is usually performed by children, often two brothers working together.

costs of producing, harvesting, and transporting the cut-and-carry feeds utilized in Hamisi's intensive management system. Data from a yearlong random survey[8] of household time allocation indicate that overall (including households with no livestock), individuals in Masumbi allot an average of 40 minutes/person/day to caring for livestock, as opposed to 30 minutes in Hamisi. These figures include

TABLE 10.4 LIVESTOCK LABOR BY AGE AND GENDER

AGE[a] AND GENDER	MASUMBI (n=504) Number of Cases	MASUMBI (n=504) Percent of Total	HAMISI (n=392) Number of Cases	HAMISI (n=392) Percent of Total
Adult male	217	43.0	76	19.4
Adult female	45	9.0	180	45.9
Male child	236	46.8	83	21.2
Female child	6	1.2	53	13.5

[a]Adult = age 20 and above. Child = age 7-19.

the direct day-to-day labor of managing livestock plus, in Hamisi, a portion of the work required to produce food/feed crops such as maize.[9] Adjusting for the larger average herd size in Masumbi (6.6 animals versus Hamisi's 3.1), the more intensive management system in Hamisi requires about 1.5 times more labor per animal.

Stall-feeding has not yet developed in Hamisi. In such systems, animals are permanently or seasonally confined, and all feeds are carried to them—as reported for the Kofyar of Nigeria (Netting 1969) and the Chagga of Tanzania (Allan 1965). Hamisi livestock still obtain a significant portion of their nourishment from grasses or bushes. Because of abundant rainfall, these feed sources are available during most of the year. While cut-and-carry feeds comprise 43% of the diet for all stock in Hamisi, the remainder of their diet comes from grazing and, to a lesser extent, browsing. As a result, the labor cost of maintaining livestock in Hamisi is probably lower than for stall-feeding systems.

Virtually all livestock labor in both communities is performed by household members. Farmers report that, in the past, relatives and neighbors engaged in considerable cooperative herding. But this is no longer common in Masumbi, and seems to have disappeared entirely in Hamisi. People attribute the decline in cooperative labor in part to the fact that herding is less important now. However, farmers also emphasize that the privatization of common lands and fallow areas has discouraged cooperation among households. (For a contrasting case, see McCorkle this volume.)

The Role of Women in Livestock Management

In addition to increasing pastoral work loads and decreasing the use of cooperative labor, intensified husbandry strategies in Hamisi have increased women's share of work. A breakdown of labor figures by gender and age indicates that while women account for only about 10% of all livestock labor in Masumbi, they are responsible for 46% in Hamisi (Table 10.4).[10] Interviews with Hamisi farmers indicate that they are well aware of the added burden on women. They

attribute this change to two factors. First, while animal care was traditionally a major male activity, in recent decades men have increasingly redirected their labor to off-farm wage opportunities (Mbabu or Noble this volume). This trend is more pronounced in land-short Hamisi than in Masumbi. Second, children (especially boys) traditionally made a major contribution to livestock care. But they now spend five days a week attending school.

Furthermore, the intensification process itself has linked livestock care more closely to the female sphere because it centers on feeding animals crop residues in the compound. Production of food/feed crops such as maize is primarily a female task. In addition, instead of watering their herds at streams, most households today bring water to the compound for the animals to drink. Carrying water, whether for human or animal consumption, is largely the responsibility of women and girls, although small boys occasionally assist. At the same time that these "female" tasks have increased, traditionally "male" chores like herding and tethering have steadily declined (Table 10.5).

Agropastoral Interactions

Another consequence of land scarcity and the resulting intensification of production has been a growing interdependence between agricultural and pastoral enterprises within the Hamisi farming system. This has taken two forms: greater use of crop thinnings and residues as livestock feed, and greater reliance on animal manure as fertilizer to help maintain crop yields threatened by the virtual elimination of crop rotations and fallowing.

Use of Crop Byproducts as Feed. As already indicated, the growing scarcity of fallow land for grazing has forced increased reliance on cut-and-carry feeds. These include both cultivated crops and wild plants that are cut and brought to the livestock in the compound. Predictably, Hamisi farmers utilize such feeds much more often than their Masumbi counterparts; they also use a higher proportion of cultivated as versus wild feeds. Cultivated crops, especially maize and napier grass, account for 80% of all cut-and-carry feeds in Hamisi. Along with the stalks of excess or stunted maize plants, maize leaves are thinned for feed while the crop is maturing in the field. During the maize harvest, stover is collected and stored for feeding to animals over the following months. Other crop byproducts used as supplemental feed include bean leaves, sugar cane tops, sweet potato vines, and the stems and foliage of banana plants. Some wild vegetation, including couch grass (*Digitaria scalarum*), thistle, and blackjack (*Bidens* spp.), is also collected for animal feed in Hamisi; but these are primarily weeds from cultivated fields and pathways rather than wild plants gathered in the bush. In Masumbi, "bush feeds" like the leaves of the *Grewia trichocarpa* and *Ficus thonningii* trees are much more important. Table 10.6 summarizes the cut-and-carry feeds utilized in each community.

Constrained by acute land scarcity, Hamisi farmers have developed a complex cultivation pattern emphasizing dual-purpose crops that provide sustenance for

TABLE 10.5 TASK-SPECIFIC LIVESTOCK LABOR BY AGE AND GENDER[a]

TASK	ADULT MEN	ADULT WOMEN	BOYS	GIRLS	TOTAL (n=504)
Masumbi					
Cut-and-carry feeding	2.1	0.4	0.6	0.6	3.7
Feed-crop production	—	—	—	—	—
Tethering/ checking	18.5	3.4	14.9	0.4	37.1
Herding	11.7	1.0	25.7	0.2	38.7
Milking	3.2	1.6	1.6	0.0	6.4
Providing water	1.0	1.4	1.8	0.0	4.2
Other	6.5	1.2	2.2	0.0	9.9
Total	43.0	9.0	46.8	1.2	100.0
Hamisi					
Cut-and-carry feeding	9.2	6.1	2.3	0.8	18.4
Feed-crop production	6.6	33.2	6.9	7.6	54.3
Tethering/ checking	0.8	2.0	1.3	0.5	4.6
Herding	1.5	1.0	7.1	1.0	10.6
Milking	0.3	0.5	1.8	0.0	2.6
Providing water	0.0	2.8	1.0	3.6	7.4
Other	1.0	0.3	0.8	0.0	2.1
Total	19.4	45.9	21.2	13.5	100.0

[a]Percent of all livestock labor observations.

both humans and animals. Detailed land use maps of four Hamisi households reveal a mean of 26 cultivars raised during the 1987 long-rains season on farms averaging 0.88 ha. A few such crops (like napier, which is usually grown in strips along erosion ditches) are cultivated specifically as animal feed. But of all the species identified, an average of 10 (38%) are dual-purpose crops. In general, Hamisi farmers are reluctant to grow single-purpose feed crops that would compete for the very limited land available for raising food for human consumption (Onim et al. 1985)

The bimodal rainfall pattern and dual cropping season in Hamisi make for a pronounced seasonality in the exploitation of cut-and-carry feeds. Their impor-

TABLE 10.6 TYPES OF CUT-AND-CARRY FEEDS UTILIZED[a]

FEED RESOURCE	MASUMBI (n=589)	HAMISI (n=3896)
Cultivated Feeds		
Maize leaves/stalks	30.1	54.1
Napier grass	19.0	16.1
Banana leaves/stems	0.7	3.7
Sorghum leaves/stalks	0.5	1.7
Bean leaves/stems	0.0	1.4
Sugar cane tops	0.0	1.3
Sweet potato vines	1.4	0.7
Avocado/mango/guava leaves	1.3	0.6
Sesbania sesbar[b]	2.7	0.4
Pigeon pea leaves	0.8	0.3
Other cultivated plants	0.0	0.3
Total	56.5	80.6
Wild Feeds		
Digitaria scalarum (couch grass)	0.5	12.9
Thistle	0.0	3.9
Grewia trichocarpa leaves	19.2	0.0
Ficus thonningii leaves	21.4	0.0
Bidens spp. (blackjack)	0.0	1.1
Lantana camara	0.3	0.4
Other grasses/weeds/shrubs	2.0	1.1
Total	43.4	19.4

[a]Percent of all such feeds.
[b]A leguminous tree introduced by the SR-CRSP as a livestock feed.

tance peaks just before and during the long- and short-rain maize harvests in July-August and December-January, respectively (Figure 10.2). In months when maize thinnings and stover are not available, stockowners increase their use of napier and other supplemental feeds like sweet potato vines. Nevertheless, during this time of year, livestock nutrition is often inadequate (Onim et al. 1985).

Use of Manure to Maintain Soil Fertility. Soil fertility in both Masumbi and Hamisi is poor (Jaetzold and Schmidt 1982). Especially in Hamisi, the inherently low fertility of the soil is further depressed by the intensive cultivation of both subsistence and cash crops raised year after year on the same plots without any fallow. To compensate, the majority of farmers in both communities use animal manure as a fertilizer. But Hamisi farmers use more manure; they

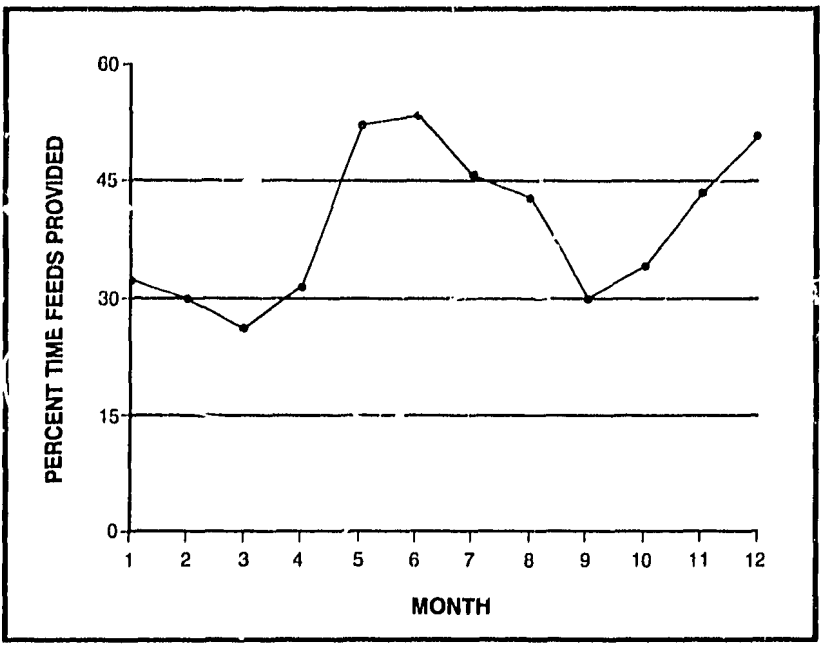

FIGURE 10.2 CUT-AND-CARRY FEEDS BY MONTH: HAMISI

manure a larger proportion of their maize fields; and they apply manure to a much wider variety of crops, including coffee, bananas, vegetables, and trees (Tables 10.7 and 10.8).

In Hamisi, animal dung is collected each day from a special room in the house where the stock sleep at night, and from the compound where the animals are tethered during the day. Sometimes the dung is immediately applied to a field adjacent to the compound—usually a coffee or banana orchard. But often it is composted with compound debris and crop residues, to be used as fertilizer later in the year. Manure is so highly valued in Hamisi that, when the compound is swept each day, most people collect even the very small droppings of goats and add these to the compost pile. By contrast, in Masumbi some farmers do not even use cattle dung as fertilizer (Table 10.8), and many interviewees were amused by the suggestion that they might trouble to gather goat dung from the compound.

Despite all their efforts, most Hamisi farmers say they do not have enough manure to fertilize their fields properly because they are unable to keep larger herds. While most Masumbi farmers reportedly fertilize their maize by simply spreading manure on the fields before planting, Hamisi farmers commonly

TABLE 10.7 CROPS FERTILIZED WITH MANURE[a]

CROP	MASUMBI	HAMISI
Coffee[b]	18	67
Banana	18	67
Vegetables	45	60
Tree crops	18	33
Sweet potatoes	9	13
Cassava[b]	7	0
Sugar cane	7	0

[a]Percent of households.
[b]Coffee is common in Hamisi, but it is grown by only three households in the Masumbi sample. Cassava is common in Masumbi but rare in Hamisi.

fertilize each maize hill individually by placing a handful of manure directly into the seed pocket (Table 10.8). Although the latter method is far more tedious and labor-intensive, Hamisi producers see it as a more efficient use of their limited supply of manure.

Given the scarcity of manure and the lower soil fertility in Hamisi, many farmers there also apply chemical fertilizer to their maize, albeit usually in small quantities and only for hybrid maize, which is planted during the main, long-rains cropping season. Some Hamisi households purchase commercial fertilizer on the market, even though this requires a high cash outlay. Others instead obtain fertilizer on credit as part of a package of inputs provided by parastatal or private agencies for use with cash crops such as tea and French beans (Table 10.8). However, this money-saving measure can cause problems. Because the fertilizer is shared with maize, cash crop yields are undoubtedly lower than their potential. Moreover, the chemical fertilizer provided for tea is not the type recommended for maize (Moses Onim pers. com.), so the benefits to maize are limited. Nonetheless, farmers' diversion to maize of fertilizer intended for cash crops emphasizes the pressure they feel to improve soil fertility. It also indicates the acute shortfall in manure, due to the small size of herds in Hamisi.

Whether in Hamsi or Masumbi, all interviewees say they prefer manure to chemical fertilizers for maize. They believe the latter can "burn the soil" and progressively deplete the natural fertility of the earth. Moreover, if chemical fertilizer is used only once and then abandoned, yields in subsequent seasons will drop precipitously. In contrast, manure is believed to build up soil fertility, with benefits lasting across several seasons. Farmers report only one disadvantage to manure: it may contain insects that can damage the crops. This does not seem to be a serious problem, however.

TABLE 10.8 USE OF MANURE AND CHEMICAL FERTILIZERS[a]

USE AND ACQUISITION PATTERNS[a]	MASUMBI (n=11)	HAMISI (n=15)
Seasonal Use of Manure on Maize Fields		
Short rains 1986	64	73
Long rains 1987	73	87
Proportion of Maize Fields Manured		
All	25	69
More than 50%	13	23
Less than 50%	62	8
Source of Manure[b]		
Cow dung from house/boma	60	100
Cow dung from compound	20	100
Goat and sheep dung from house/boma	50	100
Goat and sheep dung from compound	25	80
Method of Manuring[b]		
Spread on field	91	47
Placed in seed pocket	45	93
Seasonal Use of Fertilizer on Maize Fields		
Short rains 1986	0	60
Long rains 1987	0	20
Source of Chemical Fertilizer[b]		
Market purchase	0	27
Tea fertilizer	0	20
French bean fertilizer	0	13
Other	0	7

[a]Percent of households.
[b]More than one source and method of application may be used by a household.

Livestock Products in the Diet

The intensification of livestock management systems in Western Kenya has also triggered dietary changes. Farmers in both communities report that local consumption of blood, meat, milk, and ghee (clarified butter) has declined in recent decades. Paralleling the different rates of intensification in the two communities, this shift began as early as the 1930s in Hamisi, and as late as the 1960s in Masumbi. The main reason for the transition is said to be reduced herd sizes and lack of high-quality feed due to land scarcity and demarcation. Many informants further note that dramatic inflation in the market price of food over the past two decades has made it more and more difficult to purchase livestock products.

In Masumbi, blood was traditionally obtained by periodically bleeding live cattle; and in both communities, blood was collected as a byproduct of slaughtering cattle and other stock. But bleeding cattle is now almost unknown in Masumbi, in part because the animals are thought to be too few and too poorly nourished to withstand the stress of bleeding. Consumption of blood from slaughtered animals is now rare in both communities, too. In Hamisi, this byproduct was traditionally distributed free to relatives and close neighbors. During the colonial period, however, slaughtering increasingly became the work of professional butchers, who were prohibited by health regulations from distributing the blood. Blood consumption has been further discouraged throughout Western Kenya by the growing influence of Christianity, which disparages the practice as unwholesome and unorthodox.

Traditionally, animals were slaughtered primarily for religious purposes or because of illness (Odede 1942). During the colonial period, the development of a market for meat made it possible for households with access to cash to purchase meat (Wagner 1956). Many farmers have taken advantage of the market both to sell stock when in need of cash (e.g., for medical expenses or school fees) and to buy meat for home consumption. But spiraling inflation in recent years has made meat too expensive for many households and has forced others to restrict meat consumption to no more than once weekly. Inflation has been due in part to burgeoning human, and declining livestock, populations. Currently (i.e., in 1987), meat costs approximately U.S. $1.50/kg, or about one day's salary for an unskilled worker.

The reduced availability of quality feeds has resulted in a steady decline in milk offtake over the years. All farmers say they now consume less milk than in the past and/or rely more heavily on expensive purchased milk. In the Hamisi area, for example, the typical milk offtake per lactating cow ranged from 2.3 to 3.4 l/day in the 1930s (Wagner 1956). In contrast, the SR-CRSP's 1986–1987 survey recorded an average daily offtake of only 1.6 l per lactating cow over the year. In Masumbi, where rainfall is lower and management less intensive, this figure is 1.2.[11]

With less farm-produced milk, ghee production has been curtailed. Milk is now reserved primarily for drinking with tea and for cooking with vegetables. In Hamisi, ghee is no longer produced at all. In Masumbi, only a few households with large herds of cattle prepare ghee during the peak of the rainy season, when milk production is especially high. For most families, commercial products such as canned vegetable fats (e.g., "Kimbo" brand) are now commonly substituted for ghee.

Retaining dairy products in the diet is more difficult in Hamisi, where the small size of farms has restricted the number of cattle most families can keep. Hamisi households obtain an annual average of only 475 ml of milk per day from their cattle, compared to 600 ml in Masumbi. However, these figures mask considerable variation across households. In both communities, the SR-

CRSP survey revealed that a few families who possess several lactating cows produce much of the milk, while nearly 50% of the households obtain no cow's milk at all during the year, either because they own no cattle or because their cows are dry.

Despite low on-farm production, milk is the most important source of high-quality protein in the Hamisi diet (Conelly and Chaiken 1987). Usually taken in tea, milk is consumed in small quantities almost every day (100%) of the year in Hamisi households. Moreover, it is the *only* source of high-quality protein consumed on almost 50% of the days.[12] In contrast, in Masumbi these figures are 80% and 10%, respectively. Hamisi's higher milk consumption reflects purchases of expensive commercial milk. Households there spent an average of Ksh 18 per week ($1.12) on milk, compared to only Ksh 8 ($0.50) in Masumbi. The yearly household total of approximately Ksh 900 ($56.00) spent on milk in Hamisi represents a significant proportion of a typical family's annual income.

CONCLUSIONS AND IMPLICATIONS FOR DEVELOPMENT

Population pressure has fundamentally changed the agropastoral system of Western Kenya. With land scarcity and privatization, livestock management has focused less on herding and the use of fallow lands and common pastures, and more on cut-and-carry feeds for animals tethered in household compounds. This new strategy requires greater labor inputs per livestock unit. It also shifts the primary burden of animal care from men and children to women. At the same time, intensification has strengthened the interdependence of plant and animal components in the farming system. Maize, sorghum, sweet potato, and other cultivars have increasingly become dual-purpose crops grown for both human and animal food. Meanwhile, manure has become more important in maintaining the fertility of soils stressed by continuous cultivation. Finally, smaller herds and the lower productivity of cattle in Western Kenya have significantly restricted the amount of animal protein in most households' diets.

These findings have a number of implications for planning livestock development projects in intensive, mixed farming systems such as those described here. These implications center on the need for a clear understanding of three aspects of the agropastoral system: the division of labor within the farm household, the interactions between livestock and foodcrop production, and the role of livestock products in the diet.

First, with regard to the division of labor, SR-CRSP research demonstrates that intensified animal management in Western Kenya has enlarged women's share of labor. Compared to Masumbi, females in Hamisi contribute significantly more to the daily care of livestock (40% of the total pastoral labor); in addition, they perform most of the work of raising food/feed crops (70%). Added to the time they spend cultivating cash crops like coffee and tea, plus their numerous

domestic duties, this leaves women considerably less discretionary time than men. For example, whereas adult men in Hamisi were free of work activities (doing nothing, resting, talking, or visiting) an average of 38% of daylight hours across the year surveyed, women were inactive only 27% of the time (4.75 hours/day versus 3.4 hours/day).

Such data suggest that development planners need to be aware of the amount and type of labor that will be required by *any* intervention, whether in cropping or stockraising. In particular, it is important to realize that introducing intensive animal husbandry techniques is likely to disproportionately increase the workload of women—a group that already has relatively little discretionary time. In Western Kenya, tasks such as stall-feeding, which typically entails watering stock in the compound and cultivating special high-quality feeds, will likely increase females' labor burden. Clearly, researchers must consult *women* farmers in order to anticipate the impact of proposed interventions and accurately assess whether recommendations are likely to be adopted.

Equally essential is an understanding of the complex agropastoral interactions within mixed farming systems. This is particularly true for interventions aimed at improving animal nutrition. The introduction of single-purpose fodder crops may be appropriate in areas with adequate land, but not in heavily populated communities like Hamisi. Farmers in such communities are likely to resist devoting scarce land to new fodder crops if these are seen as competing with subsistence production. In such circumstances, emphasis on dual-purpose food/feed crops is more appropriate.

Third, the role of manure in maintaining soil fertility is also important for development planning. In intensive farming systems where manure is critical to production, any intervention that potentially reduces the availability of manure must be carefully researched. For example, the replacement of several "unproductive" head of local cattle with a single-grade animal may raise the overall "efficiency" of animal production, but it may also lower the yields of critical foodcrops. In other words, interventions that overlook the hidden benefits of traditional management techniques could have unanticipated negative consequences for the farmer.

Finally, the outcome for human nutrition of crop or livestock interventions is often neglected in development planning (Frankenburger 1987). This oversight can lead to policy recommendations that imperil rather than improve farm families' basic food security—for example, by emphasizing the production of meat for market sale (Primov this volume). Data on food consumption patterns in Western Kenya highlight the fact that farmers keep animals not only as an economic asset for sale on the market, but also as a primary source of high-quality protein in the diet. When on-farm dairy production is inadequate, households will allocate a considerable portion of their scarce cash resources to purchase commercial substitutes. These findings suggest that development planning should give priority to interventions that enhance the availability of

protein in the diet, such as improved milk production. Once basic household nutritional needs have been met, development efforts can then be directed toward production for the market.

NOTES

1. The data reported in this chapter were collected during 1986–1987 under SR-CRSP auspices (Grant No. DAN-1328-G-SS-4093-00) in cooperation with Kenya's Ministry of Agriculture and Livestock Development, with principal funding from USAID, the University of Missouri-Columbia, and Winrock International. A generous grant to Winrock International from the Rockefeller Foundation also provided valuable support for the research. Fieldwork was conducted by the SR-CRSP/Kenya Rural Sociology team in collaboration with colleagues from the Economics, Nutrition Management, and Feed Resources Projects. Special thanks are due Hank Fitzhugh, Hendrik Knipscheer, Adrian Mukhebi, Michael Nolan, Moses Onim, and Patterson Semenye.

2. This paper argues that population increase and land scarcity are the primary factors behind changes in agropastoral management strategies in Western Kenya. Though the two communities compared represent different ethnic groups, historical and contemporary sources alike document a continuum from extensive to intensive livestock practices in both groups. For example, among Luhya of the colonial period, Wagner (1956) reported that the Vugusu subtribe—which inhabited the northern districts of the province where population densities were low—had a "pastoral" adaptation. At the same time, the Logoli Luhya in the highly populated southern districts had adopted intensive management practices, including tethering and cut-and-carry feeds. Likewise, clear differences in management strategies are evident across Luo communities in Nyanza Province today. In low-density areas of South Nyanza, Luo farmers continue to herd and graze their animals on communal and fallow lands; but in Luo areas with higher population densities, intensive livestock management practices typically associated with the "agricultural" Luhya have been readily adopted.

3. Data on farming systems and livestock holdings are based on a survey of 24 randomly selected households that participated in SR-CRSP on-farm trials in each of the two communities. (See Mukhebi et. al. 1986 for a summary of results.) Estimates of farm size and the proportion of land devoted to foodcrops, cash crops, and fallow are based on sketch maps of the farm drawn with the assistance of the owner or other household members. These estimates exclude borrowed or rented land.

4. Materials in the Kenya National Archives (KNA) relevant to livestock management in Western Kenya are scattered in many different files, including the District and Provincial Annual Reports and correspondence and reports of the Agriculture Department. Here, KNA documents are cited by the specific deposits where the material was located, including the abbreviated reference number used to identify each file.

5. Statistics on population size during the colonial period before formal censusing was instituted are not based on any sound method of enumeration and are probably not accurate. I use the figures merely to provide rough estimates of population density, for comparison with more recent census data.

6. Random observations of livestock were made during the cluster visits for the household time-allocation survey (see note 8). For each household, livestock location,

activity (feeding, inactive, etc.), and method of control (tethered, herded, loose, etc.) were noted during each visit. Farmers' provision of cut-and-carry feeds and the type of feed resource utilized were also recorded. Over 10,000 observations of livestock were made in each community during the yearlong survey.

7. Hamisi's intensive, yearround cultivation requires strict control of livestock; if not carefully tended, animals would damage neighbors' fields. This is not so serious a concern in Masumbi, which has a more dispersed settlement pattern.

8. The random time-allocation method of measuring household labor expenditure is based on numerous spot-check observations of individual activities over the year. In this method, 25 households in Hamisi and 20 in Masumbi were regularly visited by a trained resident field assistant at random hours of the day, and the activities of all household members over age six were recorded at the moment they were first observed. If an individual was absent, another household member was asked to report on her/his whereabouts and activity. Whenever possible, these reports were checked by the field assistant. Cases where information was unknown or uncertain were recorded as "whereabouts unknown." This technique minimizes the errors likely to occur in time-use studies that rely on informant recall (Johnson 1975).

The sample was divided into neighborhood clusters each containing five households located close enough together to be visited in a reasonably short period. Forty cluster visits were made each month, resulting in 200 household visits and approximately 800 individual observations. Over the year, a total of 9277 and 9496 individual observations were made in Masumbi and Hamisi, respectively. It is assumed from this large number of observations that the relative frequency with which a particular activity was observed closely approximates the actual amount of time spent on the activity. The present discussion of time allocation builds on preliminary SR-CRSP research on labor availability and the time costs of livestock keeping (Nyaribo et al. 1984, Sands 1983).

9. In Hamisi, where farmers rely heavily on cultivated cut-and-carry feeds, one-third of all labor devoted to the production of dual-purpose crops such as maize is calculated as part of the labor required for the maintenance of livestock.

10. The discussion of women's role in livestock management builds on previous SR-CRSP research, including Conelly et al. 1987, Mukhebi et al. 1984, and Nyaribo et al. 1984.

11. Data on milk yields and food consumption were collected as part of a yearlong dietary survey using 24-hour recall interviews with female heads of household. The interviews were carried out between July 1986 and June 1987 with a sample of 25 households in Hamisi and 20 in Masumbi. Over the year a total of 459 interviews were completed in each community. In this survey, women were asked to report all foods consumed by household members the previous day as well as the source of the food—whether it was produced by the household, purchased (at what cost), or received as an exchange gift from neighbors or relatives. The survey provides quantifiable data on the frequencies with which particular foods are eaten. It can also pinpoint variations in the adequacy of food consumption between communities or across different households within a community. Informants were also asked to report the amount of milk produced by their household's livestock, plus all milk purchases in the previous week. Milk production reports were regularly checked by SR-CRSP field assistants, who observed the actual milking of each animal covered in the survey at least once a month.

12. Other sources of high-quality protein in the diet include fish, meat, chicken, and beans. All of these are consumed more frequently in Masumbi than in Hamisi. The dietary survey reveals the percent of days in which these proteins were consumed in Masumbi versus Hamisi: fish 50% versus 20%, meat 15% versus 14% (but larger quantities in Masumbi), chicken 8% versus 3%, and beans 33% versus 19% (bean availability is very seasonal). See Conelly and Chaiken 1987.

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11

THE TRANSFORMATION OF THE KENYAN AGRARIAN SECTOR: THE CASE OF WESTERN KENYA[1]

Nkonge Mbabu

The issue of agrarian transformation in the context of capitalist development is an old one. This chapter continues the debate, via a case study of the Kenyan agrarian sector utilizing both political-historical materials and SR-CRSP field data collected in Western Kenya between 1984 and 1987. One of the prevailing views in the debate over agrarian transformations assumes the viability, and therefore the persistence, of peasant as versus capitalist forms of social organization in the agricultural sector (Thorner et al. 1966). The apparent persistence of the peasantry has also been explained in terms of obstacles to capitalist penetration (Mann and Dickenson 1978) and resistance to change among traditional producers (Rogers 1983). However, other analysts (Banaji 1980, de Janvry 1980) predict the ultimate dissolution of the peasantry in the face of capitalist development, while still others (Kitching 1977) have demonstrated that global capitalist expansion can co-exist with peasant forms of social organization.

Whether Kenya is indeed a capitalist or a peasant society is itself a highly controversial issue (Anyang' Nyong'o 1981, Beckman 1980, Cowen 1981, Henley 1980, Kaplinsky 1980, Kitching 1977, Langdon 1977, Ng'ang'a 1981, Njonjo 1981, Swainson 1977). But clearly there is a dominant national bourgeoisie that, allied with the international bourgeoisie, wields considerable political power in the national state. In the Kenyan social formation, this alliance inclines more toward the consolidation of a capitalist rather than a peasant society.

The twin objectives of this chapter are, first, to identify empirically the nature of the changes that have occurred within Kenya's agrarian sector over time; and second, to examine theoretically the role of the global market economy in these changes. These objectives are pursued at two cross-cutting levels: the nation and the region of Western Kenya; and the past and the present. Overall, analysis indicates that, in the case of Kenya, the peasantry has not been preserved in its

entirety. Rather, it has been altered to facilitate its integration into the broader capitalist economy. Specifically for Western Kenya, this chapter complements an earlier study (Anyang' Nyong'o 1981) by illustrating how this region's agricultural sector has been articulated into the market economy and how its agropastoral population currently copes with its altered circumstances.

THE CONCEPT OF THE PEASANTRY

The concept of the peasantry is controversial. Often, it is used interchangeably with the concept of the family farm (Scheijtman 1984). However, one of the prevailing models in peasant studies is enunciated by Chayanov (Thorner et al. 1966). His theory of peasant production postulates that although each family seeks an annual output adequate for its needs, because of the drudgery involved, the family will not go beyond the point where potential increases in output are outweighed by the irksomeness of the extra work. The higher the ratio of productive to dependent household members, the greater the number of days that the former must work to meet their family's needs. While useful for some purposes, however, the Chayanovian model of peasant production is an essentially static one wherein the possibilities for accumulation are minimal and the articulation process is invisible. The only apparent potential for disequilibrium in this model is land shortage, especially given constant acreage and increasing population.

In view of the on-going integration of the peasantry into the global capitalist system, Chayanov's model thus seems inadequate. Scheijtman's (1984) notion of articulation is better equipped to capture this integration. He contends that, apart from direct family consumption, peasants also produce in order to pay forced dues to political and economic power-holders. In this way, peasant production becomes integrated into the broader political economy. He further argues that when agricultural resources are scarce, some family members may seek wage work in order to secure an income that will ensure the reproduction of the family and the unit of production. This tendency toward wage work is aggravated as the family increasingly supplies itself from the market. And because peasants are not profit-oriented, they are able to sell both their goods and their labor at lower prices than capitalist producers or fulltime wage earners. Another part of the minimal income that peasants earn from such exchanges is appropriated by capital through peasants' purchase of high-priced manufactured goods. Taken together, these articulation processes lead to what Scheijtman calls break-up tendencies among peasants. However, break-up is countered by other forces like state subsidies to the peasant sector, contract farming, and parttime labor sales, all of which favor the persistence of the peasantry.

In Scheijtman's view, this articulation process ultimately produces a stratification of the peasantry into three groups: the poor who need off-farm income to survive; simple-reproduction peasants who are barely subsisting on farm

produce; and surplus-producing peasants who have the potential for accumulation. A shortcoming of this model, however, is that it does not adequately distinguish peasants from simple commodity producers (Sinclair 1980). While the former produce mainly for subsistence, the latter mainly produce for the market. Leaving aside these debates, for the purposes of the present analysis, however, a simple, heuristic definition of the peasant form of social organization will suffice. Peasants can be characterized as small agricultural producers who own or have access to land, use simple equipment, rely on family labor, and produce primarily for subsistence (Thorner et al. 1966).

KENYA'S AGRARIAN SECTOR IN HISTORICAL CONTEXT

The Colonial Context

To understand the present status of Kenya's agrarian sector, one must trace its formation from colonial times. This is important because the British colonized Kenya partly in response to the conditions that Britain faced within the global market economy of the era (Wolff 1974). These are what led the colonial government to take many of the measures that began to transform Africans' traditional social organization of production and to integrate it into the world market economy.

Under British rule, the Kenya Territory Land Regulations of 1899 limited Africans' land rights to usufruct without title. Any land not put into immediate utilization was classified as wasteland and was thus subject to appropriation. With the Crown Lands Ordinance of 1902, these regulations were accorded the force of law, and even areas already occupied by Africans were designated as crown lands. British administrators next launched a campaign to remove Africans from the best agricultural zones in order to make space for European settlers. By 1912, the preliminary maneuvers had been completed, paving the way for the Native Authority Ordinance. This law empowered the colonial government to eject all Africans from crown lands earmarked for alienation. Africans were to remain on specially allocated lands, called Native Reserves. The vacated areas, known as the White Highlands, were opened to Europeans either as freeholds for a nominal fee of two rupees per acre or as leaseholds. Leases were initially for 99 years; later they were changed to 999 years (Wolff 1974).

Asians, too, were interested in a share of the White Highlands. Many Indians who came to construct the Kenya-Uganda railway opted to remain in Kenya, as did many of the Indian merchants who had established themselves in coastal Kenya before the arrival of the British. Some of these merchants followed the railway into the hinterland. The category "Asians" also included the Arab population residing on the East African coast before British occupation. To counter these groups' demand for land, the Devonshire White Paper of 1923

limited property rights in the White Highlands exclusively to people of European extraction. However, Asians were allocated some land in Nyanza, where they grew sugar cane (after Cone and Lipscomb 1972).

With land allocation issues out of the way, next came the problem of providing the white settlers with a labor force. The government had hoped that settlers would offer enough incentives to attract African laborers from the surrounding reserves. However, at least initially, Africans remained detached, busy with their subsistence production. Pressure from the settlers for government action eventually led to establishment of the Labor Commission in 1912, and later to the imposition of hut and poll taxes to be paid only in cash (Mutiso 1975). These measures were designed to compel African men to sell their labor to the white farms for at least a few months of each year. But these arrangements were often found wanting insofar as they did not always assure a regular supply of experienced and efficient workers. Thus, the Resident Laborers' Law was enacted to encourage African workers to squat on white farms. Settlers could then legally demand up to six months' work from their tenants. Under this law, every African household head was allocated enough land for subsistence needs in return for his labor and, if necessary, that of his family (Wolff 1974). By the 1920s, however, squatters were overflowing on the white farms. In consequence, in 1925 some of the squatters' privileges were withdrawn, thus reversing the stimulus to squatting on white farms (Mbithi and Barnes 1975).

At this time, too, colonial officials were debating the question of how to develop agriculture on the African reserves. One position opposed integrating African producers into market production, arguing that this would spread diseases to settlers' produce and thence to consumers in Europe, thus prejudicing the quality of Kenyan agricultural exports. Settlers also feared that Africans' reliance on family labor would undercut producer prices. Perhaps the most vocal claim was that, if Africans were allowed to produce for cash, their labor would be lost to white farmers. However, this fear subsided by the 1920s when squatters were in over-supply. This in part explains why, in 1922, the colonial government passed policy guidelines in favor of modernizing agriculture in the African reserves.

Other factors entered into this policy decision as well. Mutiso (1975) argues that by the 1920s missionary influences were being felt in the form of educated, Westernized African men who worked as teachers, court elders, preachers, and local chiefs. One of the lessons these "modern" men learned from their white role models was the value of individualism. It was the "modernizing men" who, in the name of scientific farm management, initiated enclosure movements to privatize formerly communal lands. Naturally, traditional elders often resisted such moves; but by the time cases were brought before the court of elders, the court was already controlled by the modern men, and rulings always favored enclosure. Moreover, trained agricola (extension agents) were so few that their efforts were devoted solely to these so-called "progressive farmers" (Cone and

Lipscomb 1972). The point is, when the decision to modernize African reserves was made, the colonial government had a target group already in mind.

Land enclosure within the reserves and land alienation elsewhere increased political agitation among the marginalized African population. The situation was further aggravated by burgeoning population on the reserves, which experienced a 1.5% rate of growth in 1934, 2.5% in 1948, and 3% in 1966 (Cone and Lipscomb 1972). The period between 1921 and 1939 was characterized by political activism organized on the basis of ethnic associations. In response to this political pressure, the colonial government instituted several measures. One was the establishment of the African Land Development Board (ALDEV) to implement soil conservation in the reserves and to prepare settlement schemes for the truly needy. The recommendations of the Kenya Land Commission were released in 1934 and ratified in 1939. From then on, what used to be African reserves now became African land units with more secure tenure. Also in 1934, the Native Grown Coffee Rules were passed to permit Africans to cash-crop coffee under monitored conditions. This further consolidated the power of the emerging African landed elite, the group that Ng'ang'a (1981) calls the peasant bourgeoisie.

It is important to note that up to this point, the colonial government had not anticipated the emergence of a large, landless rural population. True, the government had encouraged land alienation in order to benefit the white settlers; but this policy was pursued on the understanding that the Native Reserves would meet the needs of the indigenous population. It was in the new demographic context of a growing African population that ALDEV was created, both to conserve the soil in the reserves and to settle landless Africans. It could be argued that during this period, colonial policy worked to preserve the peasantry, but in a form that allowed its integration into the world market. In the mid-1950s, however, any such "preservationist" tendencies were markedly eroded by implementation of the Swynnerton Plan (see below).

As African producers entered the market, the colonial government took steps to control the marketing system. In 1932, the Native Betterment Fund was established, ostensibly to improve facilities and infrastructure for African agriculture. In fact, though, the fund represented a hidden form of taxation. It was prompted by colonists' fear of losing control over Africans' tremendous earnings from maize sales, which had been stimulated by an incentive price following the great depression. To streamline taxation methods, the 1935 Marketing of Native Produce Ordinance made it mandatory for Africans to sell their produce only through government-sponsored channels.

At the same time, the state withdrew funds from the Native Reserves. The monies were instead used to aid white farmers after the depression. This was done by reducing railway rates on export crops (bearing in mind that the European settlers produced mainly for export) and by granting subsidies and loans to white farmers. From this point on, the African Councils that oversaw

the Native Betterment Fund had no alternative but to divert money from this agricultural fund into general development projects like road building and maintenance.

The beginning of World War II marked another turning point for Kenya's agrarian sector. In 1939, the Increased Production of Crops Ordinance was passed to refine the organizational structure of agricultural production, facilitate the importation of machinery from the U.S. and Canada, and extend credit for special crops required for the war. These measures provided the boost that turned settler farming into full-blown capitalist production. One of the most significant outcomes of this shift was that squatters on white farms were largely replaced with hired labor. The squatters' displacement added to the unrest among landless Africans, fueling the political agitation that ultimately resulted in the 1952 declaration of emergency and the beginning of the war of independence.

In the 1950s commodity production increased on the reserves, following the lifting of restrictions on Africans' cash-cropping. This trend resulted from the conjuncture of several events after 1945 (Ng'ang'a 1981). First, with commodity production came a push for secure land tenure and a demand for land titles from the peasant bourgeoisie. In the same period, industrial capital was seeking to dismantle the settler system of agricultural production,[2] while finance capital was getting interested in peasant commodity production. To lend money, finance capital required title deeds for collateral; this intensified the clamor for privatization of land. At a broader level, the alliance of industry and finance facilitated the entry of foreign capital into the peasant production system.

Under increased pressure from Mau-Mau freedom fighters, in 1954 the colonial government drew up the Swynnerton Plan. This plan was initiated to convert land in the reserves into freehold title in order to provide Africans with the collateral to obtain loans. Another aim was to consolidate land for more efficient farm management. In a sense, however, this policy saw the end of any commitment to preserve the Kenyan peasantry. From this point on, the creation of a landless rural population was institutionalized. According to the Swynnerton Plan, successful farmers would acquire more land while unsuccessful farmers would sell theirs off, and then offer their labor to the successful farmers. In the long run, therefore, the plan envisioned establishment of a landed class that would be inclined to produce for the market rather than for subsistence.

Transition and the Post-Colonial Context

Between 1954 and 1960, the Lyttleton, Lennox-Boyd, and McLeod constitutions defined the transition to political independence. This transition raised the issue of what to do with the White Highlands in the face of African demand for them and many settlers' reticence to farm under what they considered politically uncertain conditions. A compromise policy was designed so as to

leave largescale farming intact but to buy out the smaller, mixed farms of whites at full market value for occupation by Africans. The resulting land schemes can be categorized into high density, low density, and Z plots (after Bienen 1974).

High density schemes were meant to accommodate landless and unemployed people. Under these schemes, prospective farmers were required to make a down-payment of only £6; and they were targeted to earn a net income over and above subsistence of £25 to £75 per annum. Low density schemes were designed to settle those who had previous farming experience. Their down-payment was £100 and their expected net annual income was £100. As it turned out, however, these income rates were too low even to provide basic education for farmers' children. And although the marketed output from these schemes increased from 30% in 1964–1965 to 48% in 1966–1967, loan defaults were common in both high and low density schemes. In 1966, 56% of the total £1.7 million billed to these new African settlers was in arrears. Finally, the Z plots were an exclusive arrangement for "community leaders." The plots consisted of 100 acres, the down-payment for which was £500 plus an extra 10% of the farm value. This heavy capital requirement automatically excluded non-elites from the list of potential applicants. Expected income in the Z plots was £240 after payment of all dues.

To the extent that these various schemes accommodated some landless Africans, it could be argued that they ran contrary to the spirit of the Swynnerton Plan. Nevertheless, they also strengthened middle-size African farms. Equally important, the resettlement schemes that emerged from the subdivision of whites' mixed farms served, among other things, to show Africans that the newly independent government was doing something about the perennial problem of land. These policies helped to legitimize the emerging independent government, especially in the eyes of the freedom fighters, whose main concern was to displace the white settlers. Schemes like the Z plots also served to reward African politicians who had supported the ruling elite during the transition period.

The post-colonial era in Kenya has retained basically the same structural arrangements established in the colonial period (Peterson 1986). Major efforts have been made to complete the land consolidation and registration program. In Kenya's 1974 development plan, for example, 16% of the entire agricultural vote was allocated to this task (Leys 1975). Interestingly, even though money-lenders have insisted on land titles for collateral, they prefer to lend to individuals with other income besides land. This favors salaried and other business people, as well as rural cooperatives. Although such co-ops were formed expressly to increase producer participation, they soon became dominated by elites who shared most of the benefits among themselves (Bienen 1974, Leys 1975).

The overall outcome of these historical events has been a clear differentiation of rural folk, at least in some regions. Some farms have expanded while others have dwindled. Both in the settlement schemes and on the former reserves, *de*

facto land fragmentation has continued in order to accommodate farmers' relatives (Bienen 1974); and despite efforts to consolidate land, at least 64% of the progressive farmers have two or more separate parcels (Mbithi and Barnes 1975).

THE CASE OF WESTERN KENYA

Western Kenya followed a somewhat different pattern than that described above for Kenya as a whole. Historically, little capital was invested in Western Kenya's agricultural sector. Furthermore, the region has continuously lost a large portion of its young male population to other sectors of the economy. As a result of these factors, Western Kenya is today characterized by limited agricultural innovation and a retarded process of rural differentiation. This situation is further aggravated by high population densities. For example, in Kakamega District (Figure 10.1) densities range between 700 and 1000 persons/km; for Kisumu and Siaya Districts, these figures are 300 to 400 and 250 to 300 (Republic of Kenya 1979). Such high population densities have made for extreme land fragmentation (see also Conelly this volume).

Taken together, these characteristics could easily mislead the casual observer of Western Kenya's agrarian sector. At face value, the smallscale farmers of the region appear very "traditional" and give the impression that they are hardly touched by global market forces. As the following analysis demonstrates, however, even this seemingly remote and backward region of the country is highly integrated into the rest of the national economy, and hence the global capitalist system.

The Colonial Context

As early as 1921, members of the Young Kavirondo Association were pushing for individual land tenure in their area of Western Kenya. But most peasant households opposed land registration for fear of losing their inheritance rights. People were suspicious of the criteria for allocating land between equal blood ties. They also feared that the chiefs would increase and consolidate their own land base and power in the privatization process, thus eroding the authority of the clan elders, *jodang' gweng'*, who were the traditional custodians of clan land.

Merchants in the region, especially the Luo Thrift and Trading Corporation (LUTATCO), supported the peasants opposed to land consolidation. One explanation of this alliance highlights the fact that the newly emerging African merchant class had recruited its shareholders from these peasant households, who were also clients for the merchants' flour mills (Anyang' Nyong'o 1981). The merchants therefore used the land registration issue to cement their political relationship with peasants and to rally peasant support against a colonial state

that blocked indigenous accumulation. The new African merchants, themselves former peasants, also used this alliance to combat the chiefs, who acted as representatives of the colonial state, settler interests, and even Asian traders. Ironically, a 1933 ruling by the Carter Commission coincided with the interests of these peasant and merchant opposition groups. The Commission ruled that there was no real land problem in Kavirondo, arguing that increased productivity could be achieved simply by applying modern farming methods and by bringing unused lands into cultivation. This decision marked a delay in land consolidation and registration in Nyanza, and curbed capital investment in agriculture in the region.

The foregoing is but one example of how, unlike many other regions of the nation, Western Kenyans successfully resisted attempts at land enclosure during the colonial period. Moreover, the agricultural development loans initiated under the reform schemes of the 1950s were terminated in the region in 1963 because of low repayment rates. Reportedly, repayments were 95% in arrears in Western Kenya, versus 20% nationally. After 1963, loan capital was restricted to sugar production at the settlement schemes.

Also in contrast to other parts of the country, Western Kenya did not adopt fullscale, commercialized cotton and coffee production. Anyang' Nyong'o (1981) tenders several explanations for resistance to the cotton venture: cotton demands too much labor and thus competes with food production; cotton is inedible; and the price paid for cotton is never enough to buy food in the market. However, these same reasons could be adduced for neighboring parts of Africa where cotton was being eagerly adopted (Fearn 1961). An alternative explanation is that the cotton venture in Western Kenya was undermined by the colonial government's need of Western Kenyan labor in other sectors of the economy (Wolff 1974). Indeed, during most of the colonial period, the region was a supplier of manual, professional, and skilled labor to the rest of East Africa.

The Contemporary Context

In 1984, the SR-CRSP conducted a largescale agricultural survey in Western Kenya.[3] Using a cluster random method, 104 farmers were sampled from the two major ethnic groups of the region, the Luo and the Luhya. The sample was drawn from five administrative divisions: Boro in Siaya District; Emuhaya, Hamisi, and Vihiga in Kakamega; and Maseno in Kisumu (Figure 10.1). From these five divisions, a total of 13 locations were sampled. From each of the sampled locations, one administrative sublocation was again sampled randomly. Lastly, from within each sublocation, a total of 13 villages were randomly selected for study. With the help of the village headmen, sampling frames consisting of all household heads in each village were then constructed. From each of these frames, eight respondents were randomly picked to compose the

sample. Whenever male heads of household were unavailable, their wives were interviewed (39% of the sample). To enrich these survey data with more detailed information, followup case studies were conducted in July 1987 with ten of the 104 households (five Luhya and five Luo).

The following sections present an analysis of the survey and case-study data according to key variables in the definition of the peasantry adopted here: access to land, types of farm inputs and implements employed (local versus industrial), use of family as versus hired labor, family composition and distribution across different sectors of the economy, and purpose of production (subsistence versus market sale).

Access to Land. Of the 104 survey respondents, 40% had access to at least one plot of land; 25% had access to two; 20% to three; and about 15% had access to four or more plots. A majority (57%) had up to five acres of available land; only 4% had more than 15. The Ministry of Agriculture in Kenya defines farms of less than 15 acres as smallholds (Leys 1975). By this definition 96% of the respondents were smallscale farmers.

It is noteworthy that all respondents owned at least a portion of the land they worked. True to tradition, most (91%) had inherited part of the land they owned. Notwithstanding, 22% had acquired some through purchase. A much lower proportion (8%) rented part of their farm lands. Fully 89% of the sample had their land registered. This measure is geared to provide farmers with collateral to acquire loans. However, only 10% of respondents had ever acquired any loans. Of the ten individuals who did, four had taken loans for farm development and another four for building a house. Of the remaining two, one used his loan for home consumption and the other started a business.

In peasant forms of social organization, all peasant households have a right to the small land units they use for subsistence. Peasants also tend to acquire their land mainly through inheritance. This acquisition pattern is a mark of traditional tenure systems, which underscore the use value rather than the commodity value of land. Coupled with smallscale production and the fact that all these farmers have access to some land, the survey findings from Western Kenya add up to important criteria that are typically used to define the peasantry. However, these apparent peasant traits should not obscure the fact that land is gaining commodity value in the study area, as indicated by the overwhelming rate of land registration in the region and the growing number of land purchases.

The case studies furnish even more compelling evidence of such break-up tendencies. Luhya respondents had a mean land distribution of 1.97 acres and an average of 6.8 children. For the five Luo cases these figures were 4.0 acres and 5.6 children. Clearly, land pressure will substantially intensify in the future, when farms are further subdivided in keeping with inheritance patterns and rights.[4] If these cases are representative of what is happening to smallscale farmers in Western Kenya generally, then a peasant form of social organization cannot long endure. The shrinking size of farms also has many implications for

the type, extent, and productivity of land use in the region. For example, this factor has been used to explain diminishing herd sizes (Conelly this volume, Ehret 1976) and the limited adoption of ploughs, which can aid the "breaking of fallow" to a greater depth than is possible with a hoe (Fearn 1961).

Farm Inputs and Implements. Survey respondents were asked to identify any purchased inputs they used in their agriculture. Negligible usage of agrochemicals was reported. Only 8% of the 104 respondents used any chemical fertilizers at all; and only 7% employed commercial pesticides on their farms. Nearly all respondents (96%) raised livestock, and 52% of the sample said that, in contrast to their cropping enterprise, they do purchase extra inputs to maintain their stockraising. These items included drugs, minerals, tethers, and dipping treatments. All stockowners in the sample noted that their animal production was not enough to meet household needs, and that they were therefore also obliged to buy milk, meat, and eggs in the marketplace (Conelly this volume).

Case-study informants were additionally asked to identify the agricultural implements they commonly utilize, and to indicate whether these items were industrial or local products. Of course, all farmers in Western Kenya use some hand tools (*jembes*, *pangas*, fork *jembes*, etc.). Thus it might seem that, in this regard at least, they conform to the definition of a peasantry. Yet the use of industrially made equipment in the case-study households averaged 73% in the Luo region (range 65% to 83%) and 82% in the Luhya region (range 50% to 100%).

To summarize, industrial penetration of Western Kenya's agricultural sector via sales of agrochemicals appears to have been successfully resisted so far. Not so for livestock inputs, however. Moreover, people's reliance upon marketplace purchases of animal products gives further evidence of Western Kenyans' integration into the market economy. Finally, the case-study figures for farm implements bear witness to smallholders' substantial dependence upon the industrial sector of the economy. These articulation processes suggest considerable potential for break-up among the region's peasantry.

Use of Hired Labor. Of the 104 survey respondents, 53% had hired some temporary farm labor in the previous two seasons. They paid their workers in cash and meals (79%), cash only (20%), or a combination of cash, food, and accommodation (2%). Only 11% used traditional reciprocal labor exchanges. In the case studies, Luo and Luhya differed markedly in their reliance on labor. For a variety of reasons, all the Luo informants reported hiring seasonal labor irrespective of family life-cycle considerations, such as whether children could not help because they were too young, or they were in school, or they were married and taking care of their own families, or they were working away from home. In contrast, only two of the five Luhya families hired any seasonal labor. This difference is due in part to the varying size of land holdings in the two regions. Average acreages among the Luo are more than twice as large as among the Luhya (6.9 versus 3.2 acres). Overall, however, survey data indicate that a

majority of farmers in Western Kenya do not rely solely upon family labor for agricultural production. The use of hired labor marks a significant deviation from one of the principal characteristics commonly used in definitions of the peasantry.

Sectoral Distribution of Farm Family Members. For survey respondents, an important source of cash was off-farm remittances. At least 59% of the sample admitted receiving regular remittances. Of the 60 respondents who specified how they spent this money, 83% said it went to household consumption needs. This information is corroborated in the case-study data. Most Luo families had at least one member engaged in gold mining or wage labor, whether in the neighborhood or in a more distant area. Similarly, a majority of the Luhya families had most of their sons scattered in other sectors of the broader economy.

The conclusions to be drawn from these findings are threefold. First, the diaspora of family members constitutes a significant linkage between rural families and the larger economy. The resulting remittances signal these farm families' dependence on non-agrarian sectors of the larger economy for their livelihood. Second, the out-migration of rural youths drains off much of the potentially innovative population. Third, the general male emigration burdens farm women with extra work as they struggle to fill traditional male roles in agriculture (Conelly this volume; de Wilde, cited in Dupre 1968; Noble this volume).

Purpose of Production. Peasants produce mainly for subsistence. The survey data reveal that an overwhelming majority of respondents (78%) grew only what they considered to be foodcrops. Only 19% produced both food and cash crops, and a mere 1% raised solely cash crops. (The remaining 2% were engaged in other, unidentified activities.) The same pattern emerged in the case studies. All ten informants said they grow only foodcrops. The most prevalent reason informants gave for this was that they prefer to raise crops that can feed their families, thus ensuring subsistence. Informants frequently added that, in any case, part of their harvests could easily be sold whenever cash was needed or a surplus was produced.

A critical finding from the survey is that, despite the fact that most respondents grew only food crops, only 8% actually produced enough food to meet their household's annual needs. Ninety-two percent had to supplement home-grown products with market purchases. This reliance on the market for subsistence items is one sign of break-up tendencies among the peasantry.

CONCLUSION

SR-CRSP findings support the argument that peasants in Western Kenya have been integrated into the broader economy of the Kenyan social formation, and that this integration has of necessity altered the very character of the peasantry. Significant indicators of this trend include: land commoditization;

reliance on the market for livestock inputs, industrially made farm implements, and food; use of hired labor; the loss of family members to non-farm sectors of the larger economy; and relatedly, a growing reliance on remittances to sustain smallholder farms.

Of course, identifiable peasant traits still persist among farm families in Western Kenya. But this fact should not obscure the underlying currents of change. Nor is it enough merely to recognize these currents; their implications must also be spelled out, lest the illusion of a persisting peasant form of social organization be maintained. This error leads to false arguments that the global capitalist mode of production co-exists with peasant forms of social organization (Kitching 1977). Such stances ignore the impact of the articulation process *per se*, which inevitably alters not only peasant forms of social organization but also the penetrating capitalist force, as it accommodates itself to local circumstances. Hence the two do not merely co-exist in their original forms.

These alterations are not automatic, however. It cannot be assumed that capitalist penetration of the rural agricultural sector always leads to the latter's dissolution. Although both the historical and field-based data presented here demonstrate that peasant forms of social organization have been penetrated by capital through monetary exchange relations, only time will tell whether this will result in the ultimate victory of capitalist social relations, as Kautsky (cited in Banaji 1980) predicts. The best that can be said here is that, through a protracted interaction between traditional peasant forms of social organization and capitalist forces, rural Kenyan society is undergoing a transformation. The outcome depends on the strength of the resistance offered by traditional forms of social organization versus the pressure exerted by penetrating capitalist forces.

Another implication of both the diachronic and synchronic findings presented here is that, even though some sectors of rural Kenyan social formation may appear "traditional," this does not mean they are isolated from the mainstream of Kenyan society. Rather, they form an integral part of Kenya's broader socioeconomic and political framework. The seeming traditionalism of Western Kenyan agriculture is merely a reflection of its peripheral status within Kenya's dependent capitalist society. In view of this fact, agricultural policy issues can no longer be considered solely agrarian matters; neither can rural development programs be evaluated in isolation from issues pertaining to the political economy as a whole. In other words—whether the focus is on plants, animals, or people—rural development projects and policies must be formulated with full attention to the ways and extent to which they feedback and feedforward to the rest of the national economy and the global market at large.

NOTES

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2. However, Ng'ang'a does not explain why industrial capital preferred peasant to settler production.

3. Percentages reported in this section do not always sum to 100 due to rounding.

4. Note, however, that these figures include daughters, who do not ordinarily inherit land from their parents. None of the families interviewed planned to endow their daughters with land. All said their daughters would instead acquire land rights from their husbands.

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