PD-AAH-825 ISN-19455 683020

REPUBLIC OF NIGER
MINISTRY OF RURAL DEVELOPMENT
LIVESTOCK SERVICE

USAID
NIGER

TOWARD DEVELOPMENT FOR PASTORALISTS IN CENTRAL NIGER

An interim synthesis report of the work of the Niger Range and Livestock Project

Rapport preliminaire - Discussion paper
Number 5

Dan R. Aronson
February 1982

Niger Range and Livestock Project

Tahaua, Niger

INTRODUCTION

The major results of the Niger Range and Livestock Project (NRL) are to be presented by the implementation team in a series of monographs on the pastoral production system as a whole. The system will be described, constraints to improving performance will be identified, and policy options will be set out.

To avoid a direct but inevitably pale foreshadowing of the team's work, and to provide information in the form most directly related to planning for a possible second phase NRL, this synthesis is organized differently. Each major component of project work is synthesized in a separate chapter, in the expectation that the fate of each component in any second phase project will need to be discussed in detail.

The chapters which follow present the work of the NRL in range management, in veterinary health, in animal nutrition, in livestock water supply, in subsistence production, in cooperative formation, in human health, and in livestock marketing. All of these topics are of course integral aspects of pastoral production, but they are discussed as separable entities, each of which has been a focus of NRL work.

Two points may be made about the list of topics. First, it is not the same list as in the RN/USAID Project Agreement - instead, it represents the major foci of actual project work as it has evolved. Second, the list is not exhaustive of all project work: some areas have been omitted here because work in them was so inconclusive or scanty (communications, animal predation), others because it would have been premature to discuss what are highly preliminary findings (on herd and human demography, for example), yet others because they have been treated as "action d'accompangement", not as central to the project (participant training, material aid to the Livestock Service). More details on project elements omitted here are contained in the 1981 NRL Project Evaluation.

The emphasis here is on the ways in which each component of project work bears on the overall issues of production and productivity. With many differences, to be sure, the NRL (and the two other major livestock projects of the MDR) is the equivalent for the pastoral zone of the cereals-oriented productivity projects in the agricultural zones of Niger. NRL research and work on pilot interventions have been designed with a clear focus on exploring ways to increase productivity in the livestock sector. There is a healthy skepticism among project staff that any outsiders can improve on what pastoralists have learned over the centuries about how to make their system work. But there is at the same time an enthusiasm to work with the pastoralists to see whether some elements or others in their systems can be made more efficient, more profitable for them, and more productive. Work in range management or veterinary medicine may seem obviously directed to production: in the NRL, work on cooperatives and in human health delivery is also seen for their potential contributions to over-all productivity.

Each chapter summarizes what is known about the given topic in the project zone. References to research outside the NRL indicate why and how the NRL is building on (or in some cases, neglecting) prior work. The driving ideas in the NRL work are then discussed, as are results that have appeared so far. (Where extensive summaries of project work have been prepared, they have been set apart in the typing format.) Sections on "planning considerations" are meant to highlight issues known to be under discussion; or which bear on potentially controversial matters, in order to show how NRL project work may be helping to provide a rational basis for decision making.

ACKNOWLEDGEMENTS

The author is grateful to the Ministry of Rural Development and to the Livestock Service for permitting him to continue his association with the exceptional project it is undertaking. The Director of the NRL Project, Dr. Ali Dankintafo, set an example that pervades the NRL staff in being open, generous with his time and resources, and enthusiastic to help with the present report for the overall benefit of the Project. Both in Niger and in the U.S., NRL project staff took time from busy schedules to explain project work in painful detail to an outsider and a layman as far as many disciplines were concerned. USAID staff in Niger and in Washington were, as always, anxious to see that this small consultancy went smoothly. In Boston, where the report was written, Brigitte Schulz turned handwriting into type with speed and concern that improved the original.

Above all, the author is indebted to Martha Starr, who acted as research analyst and helped in the writing of several chapters. Wading through many hundreds of pages, decipthering only partially-explicated data, and analyzing the main thrusts and linkages within the diverse materials were much larger tasks than was first anticipated. This report would not have been finished without Martha Starr's skillful aid.

I. RANGE MANAGEMENT

A. INTRODUCTION

This chapter of the report analyzes the efforts of the NRL in the general field of range management. "Range work" was seen to be a major new disciplinary contribution to the livestock sector in Niger, since the American science of range management was not pursued in the European traditions from which Nigerien livestock activities had earlier derived. While all historical livestock-producing societies have of course "managed" their resources, the academic disciplin of range management promises to analyze, experiment with, and manipulate any (or all) of the eco-systemic variables in livestock production systems for the sustained optimization of given production goals. Within this broad context (including, as it does in principle, human, climatic, hydrological, botanic, and zoological factors), range management in practice focuses on the interaction between economic species of livestock and the actual or potential forage available on the rangelands. The NRL set out to analyze current vegetation/livestock relationships and to discern new practices that might increase the value of total livestock production while maintaining or even enhancing the condition of range vegetation.

It was the drought of 1968-1973 that compelled the search for the "right" balance between the range resources and the livestock. Nearly two-thirds of the national herd had been lost to starvation (or distress slaughter). It was widely assumed that the desert was steadily encroaching. Even if there now was, because of the huge losses, room to reconstitute the herds, surely some controls would be necessary to prevent the overgrazing of what must surely be degraded rangelands. But what <u>was</u> the right intensity of grazing?

Earlier work on Sahelian rangelands had attempted to establish the quality and quantity of the forage on different types of pastures. The goal was to find the carrying capacity for each type of pasture, and to regulate grazing accordingly (see, e.g., Rippstein and Peyre de Fabregues, 1972: 26-28, 214 ff.). By contrast, a range management program derived from American practice promised a more active experimentation with manipulation plant and animal species towards

progressively raising the productivity of both range vegetation and livestock. The NRL range management component was to "define and demonstrate technically feasible ways of protecting and improving the natural resources of the project area" (Project Agreement: p.13).

Both the older methods and the "new" methods of range management required substantial research on existing conditions. Since prior research in Niger had been limited to a few small zones, and since range conditions were thought to have been profoundly changed by the recent droughts, research in the project zone was to be mulifaceted (mapping, vegetational analysis, range agronomic experiments, etc.), extensive for the whole project zone, and planning-oriented. The next three sections summarize what has been learned about the existing rangelands, about the current use of the rangelands, and about possibilities of manipulating animal/vegetational dynamics for improved livestock productivity. A final section will discuss implications of the present NRL range research.

B. RANGE CONDITIONS IN THE PROJECT ZONE

1. Research prior to the NRL

The major study of Nigerien rangelands prior to the NRL had taken place from 1969-1971 under the auspices of the Ministry of Rural Development (MDR), for the Livestock Service, and executed by a team of French agrostologists, cartographers, and veterinarians. The "Etude Agrostologique," published in 1972, was part of a larger set of studies for the modernization of the pastoral zone, and was complemented by hydrological and economic studies. It set out to define the types of pastures and their distribution, the productivity of the vegetation and the pasture cycles, and to produce maps and plans based on the results. The study covered virtually all of the pastoral zone of Niger, not just the NRL zone later delimited, and climaxed a long series of specific studies by individual scientists.

The "Etude Agrostologique" (Rippstein and Peyre de Fabregues 1972) defined three major natural regions in the pastoral zone. The NRL project zone comprises the central part of the "southern region" (The Plateau of Tadress) and portions of

neighboring sub-regions. After summarizing the climatology, geology, and pedology of the zone as a whole, the study presents details of four major soil-vegetation-topographical groupings. The NRL zone is in the "Sahelo-Saharian" sector and is characterized by a shrubby steppe with annual grasses. Over the three major soil types (course sands, fine sand and loam, sandy clays) there are in the main portion of the NRL zone three vegetation associations deemed "good pasturage," and three deemed "average." "Good" and "average" judgments are based on the adequacy of protein supply in the dry season. Both total vegetative production (in kg/ha) and livestock carrying capacities (in ha/UBT) are computed. Between 6 and 12 hectares per tropical bovine unit are typical charges as suggested as appropriate for these principal pasture types in their "Sector C," which corresponds roughly to the southern two-thirds of the NRL zone. The study suggests (p. 251) that, based on feed and water potentials, a light intensification of livestock above 1969 levels could be envisaged for this zone.

2. Research in the NRL

The Project Agreement called for surveys and mapping of the Project zone to establish carrying capacities anew in the post-drought period. After delays in beginning this work in 1981, the NRL introduced to Niger an innovative methodology developed by the International Livestock Centre for Africa (ILCA) for this type of extensive analysis. The new technique consists of low-level (800 feet, or 243 meters) aerial surveying along map-based flight lines used as a sampling grid, with trained observers (backed by photography) inventorying livestock types and populations, human community types and population, ecological conditions and water sources. The aerial survey was flown twice in 1981, once late in the dry season (May) and once at the end of the rains (October). This pioneering method offers hopes for sophisticated long-term range monitoring and land-use planning, and is being developed and tested in Malian and Nigerian work as well as in Niger.

The first aerial survey identified five major "land units" (plus farmed lands), the first three of which "represent a transition passing from south-east to north-west" (Milligan 1981:12). These three major units were all "Sahel savanna," the first with some tree cover, patchy tussocked perennial grasses, and flat or gently rolling land; the second with mixed annual and perennial grasses, trees concentrated in seasonal pond areas, and arrested dunes in undulating land; and the third with sparse tree cover, annual grasses except

perennials at seasonal ponds, and dunes or arrested dunes in run-off and dry river floodplains and hilly terrain. Grass, trees, and farmlands were inventoried by percentage of cover in the survey grids.

The aerial survey covers a vast area quickly, and its sampling methods are intriguing. However, the ecological units identified are at present more general (based on morphology, not pasture types) than those of the earlier "Etude Agrostologique," and comparisons over time will remain difficult until particular vegetation associations can be identified from the air or by ground truthing. So far, no attempts have been made to analyze carrying capacity or develop grazing recommendations on the preliminary bases provided by the air survey methods.

Aside from the aerial survey, no project research has examined, in situ in the rangelands of the zone, the existing range types, their variability, or their nutritive qualities. Vegetation mapping work and the "herd dynamics" study planned for the last year of NRL will begin to remedy this major gap, but will remain one-time studies. For other aspects of the herd dynamics study, see below.

C. RANGE USE IN THE PROJECT ZONE

Socio-economic research in central Niger has been extensive. The knowledge that began to be developed many years ago and that has been amplified by the NRL is well along the road to specifying closely the various and changing ways in which the rangelands are used by the human communities and herds that occupy them.

1. Research prior to the NRL

Early research dealt with small groups, and focussed on the general patterns and principles of social and economic life among them (e.g., Nicolaisen 1963; Dupire 1962 and 1972; Bernus 1974). The excellent descriptions and analyses, together with work done elsewhere in the Sahel, have provided firm background for all subsequent research.

This research established clearly the ethnic differentiation in range use patterns between Tuareg and WodaaBe pastoralists in (and beyond) the NRL zone. Tuareg groups, with historically deeper claims to homelands in central Niger, own the largest share of the traditional wells, have prior claims to many of the range resources, have a more diversified economy than WodaaBe and so depend less on livestock alone. WodaaBe are more recent immigrants to the zone, use public wells much more often than they own their own wells, and tend to depend more fully on their livestock production. Although the two populations (and smaller groups, of Arabic-speakers, Farfaru (Fulani) from Nigeria, Igdalen and others) interdigitate across the zone (with movement northward and westward), while Tuareg are densest in the southwest and central areas of the zone. Camels, and goats tend to be concentrated in Tuareg herds, while cattle (and to a lesser extent sheep) are concentrated in WoodaBe herds, but this species differentiation is not at all hard and fast. Husbandry technology and techniques the forages preferred by different species in different habitats, and the principles underlying transhumance and livestock investment decisions are all outlined in these monographs. In addition, these works demonstrate the relative restriction of particular social groupings to particular base areas and transhumance routes.

2. Research in the NRL

The early research provides rich soil in which all current studies are rooted and nourished. Current research is attempting to specify: (a) all the existing water points and the groups who use them (see section on water use of this report); (b) the distribution and composition of herds right across the zone; (c) the details of husbandry techniques, range management practices, and transhumance decision-making by each of 150 pastoralist families in the zone; and (d) the animal-vegetation relationship in the actual conditions of the zone by means of the intensive observation of a single herd in the forthcoming "herd dynamics study."

This work represents a profound intensification of knowledge about the zone. In terms of range management planning, it should provide broad information on: (a) the types of livestock enterprises that exist in the zone (that is, not only by ethnicity of the producers but by size and composition of the production units, centrality to total income of the herding enterprise, ownership and management styles, and so on); (b) the forms of access to productive resources (the bases of land and water rights of many particular groups, the ownership of animals, claims to services, etc.); and

(c) the intensity of production (human and animal densities, seasonal variation, labor productivity, etc.).

The first aerial survey has already provided some data which modifies earlier generalizations about the zone. It showed that (in the dry season, at least), cattle were, as expected, concentrated in the southern part of the zone, reflecting their grater concentration in WodaaBe than in Tuareg herds. Sheep, goats, and camels were dispersed across the zone more or less as a function of the total human population, or to put it conversely, camels and small ruminants are not highly overrepresented in Tuareg herds (Milligan 1981: 12-13). Among cattle, those of the Azawak breed (54% of the herds sampled) were concentrated in areas where Tuareg are dense as well, while Bororo breed cattle are densest in the areas inhabited by WodaaBe. Azawak herds were more widely dispersed and smaller (ave. 29 head vs. 38 head) than Bororo herds, a larger proportion of which were also large herds over 50 head. Since sheep and goats were not distinguished in the counting, it may still be true that they appear in different balances in different kinds of livestock enterprises. Camels are less frequent in both Tuareg and WodaaBe herds in the southern part of the zone. The species diversification of WodaaBe herds may be a phenomenon more recent than the early research which emphasizes (overemphsizes?) their cattle herds, but it is a phenomenon confirmed by the aerial survey.

Because much of the work on range use patterns is being produced by members of the socio-economic team whose data is just now beginning to be processed, it is impossible to summarize any results here. We can, however, comment on one major underlying issue, that of the rationality of existing pastoral practices. The conviction of the NRL team that practices <u>are</u> rational, and correlatively, that the herders must participate in working towards any possible improvements in the system, sets the basic posture of not rushing toward quick technical changes in range management (or other domains) no matter how well they may have worked elsewhere.

It has become ever more evident that the pattern of range use is far from "anarchic" or "irrational," two descriptions laden with emotion that are still often used to describe existing (or so-called "traditional") systems. "Anarchy" may have different connotations in French and in English: in English, it is quite pejorative, while in French it may with less accusation refer to a condition of dispersed or highly decentralized authority. In any case, central Nigerien range use is only "anarchic" in the strictly

limited sense that range use decisions are made by individual producers in an iterative manner, which has the outstanding result that the energy potential of the plant species are effectively and efficiently harvested by livestock in large part for eventual human consumption. This decentralized and vigilant decision making about herd movement and production optimization is true of herders nearly everywhere, even those who actually manage the animals on the rangelands of societies with fully privatized systems of land tenure. Whatever improvements can be developed for herders to be more productive, "anarchy" will have to continue if livestock productivity is to remain high. We cannot substitute centralized decision-making for that of the herd operator until that moment - not yet even foreseeable - when "central" information is as up-to-the-minute as his is and when centralized experience is so thorough that it permits decisions based on new information as skillfully as the herder's own.

Some of the proof of the success of existing systems comes in a new study done in Mali by a Malian-Dutch research project, "Sahelian Primary Production" (PPS). It has shown that per hectare, as much (or more) animal protein is produced in the Sahel as in comparable regions of Australia and the United States. (The figures were: U.S.A., 0.3-0.5 kg/ha/year; Australia 0.4; Sahel transhumant production 0.6-3.2; and Sahelian nomadic production 0.4. See Breman 1981: 14, 19). The Australian and U.S. systems were far less labor-intensive, and far more capital-intensive.

The "anarchy" of existing practices is thus probably a positive factor in pastoral production. But if "anarchy" can be retained as a descriptive term in this contrary sense, "irrationality" cannot. Pastoral practice has often been called "irrational" by those people who seek to control it or replace it, or who seek on political grounds to sedentarize nomadic producers. But those who seek to understand pastoralism as an economic (and social) system have no difficulty discerning its rationality - indeed, millions of people in West Africa subsist from pastoralism only because they have devised and keep improving systems of rational adaptation to existing (and changing) resources and circumstances.

The household economic studies will elaborate the particular rationality of production in central Niger. In addition, a study completed by Angello Maliki (1981b) for the NRL is a graphic demonstration of the logic of herding. Entitled Nraynaaka: Herding According to the Wodaabe, it discusses the structure of the herd,

seasonal pasturing practice, husbandry of the cows (especially the management of reproduction and the new-born), knowledge of forage and veterinary disease, religious practices associated with herding, and production goals and strategies. It is, in short, a monograph on central elements of the WodaaBe science of animal production.

Other parts of Malik's work will be referred to at appropriate points. In terms of range management, he undertakes two major tasks. First, he identifies local plant species by their Fulfulde and Latin names and by characteristics of edaphic association, apparent nutritive value and palatabitity (pp. 66-75). This work adds to earlier studies, and for example can be cross-checked with the "Etude Agrostologique" to compare Western and WodaaBe judgments on forage value. Where there are conflicts, interesting field research might follow.

Second, he discusses the "conduct of the herd" by WodaaBe through the seasons. The value of frequent watering and frequent change of forage species during the rains, the apparent qualities of different water sources as well as pastures, the movement to mineral-rich areas, the contribution of periods of sun and shade to good lactation, and the loss of palatability of maturing grasses in the southern part of the zone are all generalizations in WodaaBe herding science that could be tested as hypotheses by government range scientists for inclusion, refinement, or rejection as parts of eventual improved mangement systems.

To assume the irrationality of existing pastoral systems is to risk attitudes of rejection and superiority on the part of technicians who must deal every day with the pastoralists. Such attitudes can have only negative consequences. Directly to the contrary, range management advisors to the NRL have discussed the ways in which the careful understanding of other "traditional-but-rational" systems of herding (in Ireland and in Iceland) forms the foundation of range research programs. Future range management research in the NRL (beginning with the field study of husbandry practices now getting under way) is well-advised to assume the pervasive rationality of current practices, and to work with and for the practitioners.

D. RANGE RESEARCH IN THE NRL

A concept central to range management in the past has been "range condition," that is, " the state and health of the range based on what that range is naturally capable of producing" (American Society of Range Management 1964). The measurement and management of range condition has occupied center stage in range science, but for livestock production purposes this preoccupation has been somewhat misplaced. Studies of range condition and trend were developed by foresters and botanists, for whom cycles of plant succession were key ideas. Plant successions can unfortunately be isolated from livestock issues, with the goal of restoring or achieving climax vegetation coming to have an importance that treats livestock production as a negative influence.

In the NRL, the focus of range research has been toward a more progressive goal, namely the achievement of the "highest level of animal prodution commensurate with maintaining or improving range conditions." This is a definition of "grazing management" goals rather than mere range vegetational management goals. While animal management is just one of the possible methods of improving range condition (reseeding or water development are others), grazing management focusses squarely on the vegetation/animal relationships within which animal production, not climax vegetation, is the key outcome.

1. The context of present NRL research.

The range management team in the NRL, under the leadership of Dr. Robert Bement, has been attempting to define animal production potentials with this "grazing management" goal. The task is a complex one, since animals and plants react to one another's presence in complex ways. The team's research is open to the influence of a multiplicity of factors, and begins by refecting a lange number of fallacies often repeated and widely held that might - if they were credible - set narrower limits on the research. They include:

(a) The fallacy that climax vegetation should be "restored" on the rangelands. Despite the laments of some range managers that "palatable and nutritious perennial grasses" (Project Paper: 130) of the past had been replaced by annuals to the detriment of the rangelands and the livestock, there is little or no evidence that

Sahelian ranges were ever closer to presumed climaxes than they are now. The mix of forage (and browse) species that provides the best nutrition for the optimal animal species mix is the object of research, not the "restoration" of perennials for its own sake. Even the determination of climax vegetation in exclosures or by other means is a minor issue for the present research team.

(b) The fallacy that carrying capacity can be determined by evaluating the forage value and quantity of existing plant species. While present carrying capacity might be so determined, carrying capacity itself can be modified by manipulating the plant species by such factors as grazing intensities themselves. The "treatment" (grazing intensity and duration) given a pasture can alter the plant species mix, with carrying capacities changing in turn. The phrase, "cows eat grass, not hectares," is meant to signal that grass is a variable, not a given (or a function only of water and plant nutrients) in any grazing system. While the "Etude Agrostologique" recommended light intensification of grazing in the NRL zone based on computation of carrying capacities, the NRL research team has made no such computations and does not necessarily accept the present plant mix as immutable.

(c) The fallacy that plant biomass is positively related to nutritional quality. Few animal production specialists would accept such a generalization, of course, but ideas persist that satellite sensing of biomass can guide herd movement decisions. WodaaBe, for example, recognize that as grasses mature they lose nutritive value, and they move northward following the new, low growth (Maliki 1981b: 41). The PPS confirms (Breman 1981: 10) that protein content is higher where water availability is relatively lower (nitrogen is diluted by water, and so protein content falls as more water is available). So, no special value attaches to the idea of large quantities or densities of grass: nutritive values must be computed not only by biomass, species, and season (as the Etude Agrostologique does, for example) but by phenological stage as well.

(d) The fallacy that the heavier the grazing intensity, the more danger there is to the rangelands. The reality is that animals and vegetation are in such dynamic interaction that heavy grazing may yield real long-term benefits: browsing animals are one major form of control of bush encroachment onto grass pastures, for example, while heavy grazing may crop certain species and thereby

enable other species, of potentially higher value, a beneficial "place in the sun." The NRL grazing trials show some interesting results, a summary of which follows below.

(e) The fallacy that fire is always a negative factor. This mistaken belief often leads to expensive programs for fire control. The NRL recognized that grass fires were rarely extensive in the project zone, and so did not plan fire control measures. To put the issue even more strongly, however, it can be argued that burning can provide more palatable and more nutritious regrowth in places where the standing forage has lost nutritive value with age. Burning can also discourage bush encroachment. For these reasons controlled burning trials were envisaged for the NRL. Some burn areas were observed by NRL team members (see Simpson 1981), but no consistent comparisons have been written up concerning on-burn regrowth, extra growth at the burn margin from the "mulching" effect of blown ash and fragments, or ongoing non-burn growth in neighboring areas.

(f) Summary. If one sets aside all these fallacies, as the range research team has, then one can explore livestock/vegetation relationships in a highly open framework in which factors are manipulated within wide limits. The range plant species mix as presently constituted need <u>not</u> be accepted as the basis for planning grazing limits; the consequences of grazing intensities much higher than those on the rangelands can be examined experimentally; the ongoing production results of particular pastures can be examined without regard to arbitrary assumptions of seasonal or species benchmarks.

2. <u>The research framework</u>.

The range management team has thus chosen a highly experimental strategy that contrasts strongly with much of the work that has gone on elsewhere in the Sahel. As noted above, its major deficiency is the lack of connection of its critical parameters to existing production systems. Its potential strength is the discovery of radical new methods of grazing management that are at least technically feasible for the zone.

This high-risk research strategy is organized in the following way:

(a) Controlled grazing trials have been set up on fenced pastures within the boundaries of herd multiplication ranches at Ibeceten (northeast of Tahoua) and at North Dakoro. The criteria of selection rested primarily on the fact that the dominant pasture species at each site (Aristida mutabilis at Ibecetene, Cenchrus bifloris (Cram-cram, or prickly African foxtail) at North Dokoro) was highly typical of large areas in the zone (and of the Sahel at large: see G. Boudet 1977: 169).

(b) The aim has been to establish maximum livestock production levels for different kinds of pastures by examining livestock and vegetational responses to wide differences in treatment.

(c) Since the vegetation composition itself may change as stocking rates vary, long-term observation and manipulation of pastures is necessary before optimum relationships can be established with confidence.

(d) The livestock "production level" has two major aspects: production per individual animal, and production per unit area (that is, at the herd level). The two aspects are partly independent of one another, since, for example, production per unit area can still increase by the addition of animals even after the individual animal is sated and producing at a maximum level. So both factors must be measured and the response curves plotted. Output can be usefully measured by weight gain and/or milk production levels.

(e) Since the variables of plant species mix; climatic influence, and stocking rate are already complex and interactive, first experiments are kept as simple as possible by using only heifer, with the later addition of three lactating females to measure milk production. Mixed grazing trials may come later.

(f) Three separate pastures are used in each trial, one stocked heavily, a second pasture twice as large stocked at a medium rate, and a third, three times the size of the first, stocked at a light rate.

(g) The goal of this research strategy is to identify the point at which maximum productivity occurs on any pasture, in such a way that the individual herder can decide how many animals to move to a particular pasture and when to move them on and off. This approach is herd management oriented, and not oriented toward centralized decisions on total stocking rates for large areas of rangeland.

3. Research results.

The grazing trials began (late) in the rainy season of 1980, and have now continued through a fully dry season and a full rainy season in 1981, with a second dry season now in progress. A second full rainy season in 1982 will complete the present series. Vegetation is measured in sample plots, and extrapolated to estimate pasture mass and composition at the outset. Estimations of mass are repeated at monthly intervals, in each of the Light, Medium, and Heavy treatment. Species change is recorded twice a year. Animal response, in weight gain, is also measured each month. The Evaluation team observed that even the Light stocking rate in the trials was heavier (5 to 6 ha/UBT) than in the zone outside the study sites (6 to 9 ha/UBT), so the experimental conditions are extreme. Detailed results have been presented in the successive reports of the range research team. Their central points may be summarized as follows:

(a) In the first rainy season (1980, truncated by a late start), per animal and per unit area gains were made until there was only 180 kg/ha of forage left of the Aristida-Cenchrus-Brachiaria mix at Ibecetene, and until 300 kg/ha were left of the Cenchrus-Schoenefeldia mix at Dakoro. Gains per animal were high (6, 11, and 11 kg/animal respectively in the heavy (H), medium (M), and light (L) treatments) the first month at Ibecetene, but fell off thereafter to no or negative gains, so that by season's end only those on the light use pasture had made a net gain. At Dakoro, gains per animal continued on the M and L pastures for two months, and on the L for a third, but then losses began sharply to reverse earlier gains.

(b) In the first dry season (December 1980 - June 1981), a new set of heifers was brought into the trials. At Ibecetene, animals started to lose weight once there was less than 350 kg/ha of standing vegetation. Individual animals in all pastures gained from 15 to 17 kilos the first month, more or less held weight through February, then lost from 10 to 12 kilos in March. Then in the extreme stress of April to June, the average heifer in the H pasture lost a further 4 kilos (a net loss of 13), in M a further 5 kilos (for a net gain of 0 over the whole trial) and in L a further 6 kilos (a net gain of 5 kilos). For the three lactating cows, milk production dropped by one-third in the L and M pastures (from 1.9 to 1.3 liters/morning milking) and to almost nothing in the H pasture after one month in the trials. At Dakoro, the animals started to lose weight after one month no matter what the quantity of standing vegetation. "Forage quality drops so low that it is impossible for the animals to consume (enough) to maintain their weight" (Bement 198 1b: 14). Results were like those at Ibecetene, with the heifers gaining from 12 to 15 kilos on average the first month, then sustaining losses, with a net gain by all the beginning of March of only 1 to 5 kilos. From March on, the animals steadily lost

weight so that net changes per animal over the whole trial were losses of 16 kilos, 12 kilos, and 10 kilos respectively in the H, M, and L pastures. For unexplained reasons the milk cows in the H pasture produced more than the others, even two months into the trials.

(c) The second rainy season trials began in early June, 1981, but were not yet analyzed by the time this summary was prepared. Since the second rainy season trials were on exactly the same pastures as in the 1980 trials, the effects of grazing on the plant community should begin to cumulate.

The effects of these livestock treatments on the pastures are also calculated by the range research team. The most remarkable observation to emege so far is the surprising change in species mix in the Dakoro 1980 rainy season heavy use pasture. There, heavy grazing cut the rate at which soil moisture was lost by evapotranspiration through the plants. With moisture thus left stored in the soil, perennials (notably Aristida pallida, Cyperus conglomeratus, and Chrozophora brocchiana) greened up during the dry season, and one herier remarked that the pasture looked like it might in the rainy season. The obvious implication of this result was that extraordinarily heavy grazing followed by resting of certain pastures for some months might produce a new green protein-rich crop at precisely the time of year it is most needed (Bement 1981a: 19 and 1981b: 22-23). Further measurements of moisture retention rates under different animal treatments are being made with soil moisture blocks set at different depths in each pasture starting in late 1981.

4. Implications.

From its work, the NRL range management team is beginning to draw certain interim conclucions and leads for further research. First, heavy grazing at least on certain types of pastures may improve the productivity plant community and produce a completely new vision of its "carrying capacity." Second, the initial gains made by the animals in the first month's grazing during the dry season might be repeated by rotating to a paddock not yet grazed. This hypothesis is being tested by deferring the opening of paddocks within the L pastures in the (current) 1982 dry season. Third, controlled firing of the ranges may have nutritional benefits.

It was suggested above that the NRL range research strategy has been a high-risk one. By mounting experiments related neither to the prior Sahelian literature nor to the existing WodaaBe or Tuareg production methods, the team has both developed some interesting hypotheses and risked only rediscovering wheels already well-mounted. Thus one of the Nigerien students in U.S. training, writing at the end of a summer visit, comments that "an experiment is good only if ... generalization can be done to ... the whole zone" (Maidaji 1981: 11). Further thinking needs to be done about establishing an experimental framework that will lead in regular stages to implementable range management principles in the project zone.

Perhaps the most urgent adjustment has to do with the issue of grazing control. The range team is convinced that any technical package it could conceivably develop would require full controls - whether through the allocation of private property rights or not - of grazing access. Neither socio-economic observers nor government think such controls are socially or policically feasible in the foreseeable future. The challenge to range management is to devise methods and interventions that can be realistically applied in Niger.

II. VETERINARY HEALTH

A. INTRODUCTION

1. The Lack of a Veterinary Component in the NRL Design.

Improvements in veterinary health are obvious interventions to attempt in livestock development projects, for many different reasons: (a) In the short term, at least, they provide a quick payoff in increased per animal and per herd productivity; (b) they can help extend the efficacy of the most central part of the livestock service, its veterinary health program, and thus build from existing strength; (c) They are the most direct way to the herder's hearts, and can therefore engender solid enthusiasm for the project; (d) Compared with, say the more complex institution-building involved in the development of cooperatives, they are relatively easy to mount.

The wonder may therefore be that the NRL did not make support of the veterinary activities of the Livestock Service a core component of the Project. The veterinary consultant to the NRL registers some surprise that it was only "after operating in the NRL zone for several years (that) the management and field staff of the project came to realize that animal health was a prime concern of the herders in that zone" (Sollod 1981c: 4).

In fact, this recognition was not simply belated. As the 1981 NRL Evaluation Report noted, at the time the project was designed, veterinary health measures were seen to have been major contributors to what was judged the dangerous overstocking of Sahelian pastures. In that context, aid to veterinary services was seen as immediately detrimental to reestablishing a balance between pasture resources and stocking rates. Of course animal health was a prime concern of the herders, but the hard decision was that health should not be improved at imminent expense to the range. (For discussion of hydraulic and veterinary measures as parts of the Sahelian problem, see e.g., Bernus 1977: 144-145).

2. Changed Perceptions of Veterinary Intervention.

The Evaluation Report goes on to trace the developing realization that desertification was not necessarily spreading steadily through the zone and that animal numbers were not proving to be excessive. Indeed, the grazing trials seem to indicate that systematic changes in grazing and rangeland management might permit a substantial increase in these numbers above and beyond the point at which stocking rates returned to pre-drought levels. It took research data from various areas of the Sahel to shift the terms of the discussion away from the alarmism of the period of the drought, and once the shift began it became possible to reopen questions of veterinary support.

No one doubts the general point that veterinary interventions can raise productivity. The proportion of total potential production gains that can come from veterinary (as distinct from nutrition, or range management) interventions is a more open question. Health improvements can yield high rates of return (see the Economic Analysis in the NRL Project Paper), but once the most pervasive threats to health have been overcome, each additional increment to health status comes at a higher price. Points of diminishing return to added investment will come even faster if commensurate changes in husbandry and nutrition fail to occur. Furthermore, of course, appropriate strategies for amelioration animal health conditions can only be devised in the light of full knowledge of existing health problems, administrative structures, and socially feasible options for intervention in the project zone.

3. NRL Veterinary Support.

The NRL has been approaching veterinary matters in a number of ways. It had given limited financial support to one of the annual veterinary campaigns. It is completing the construction of veterinary posts in four settlements within the full pastoral zone where it seemed reasonable to at least extend the level of service available farther to the south. Other USAID support has gone to the veterinary laboratory in Niger and to building up the veterinary pharmaceutical supply system (VETOPHAR), to the establishment of veterinary posts on stock routes near Niamey (through the Entente Livestock Project),

and much earlier to the JP-15 Rinderpest campaign in the 1960s. As well, the NRL socio-economic team has been collecting information relevant to veterinary matters.

> Tenditionally, veterinary skills were developed by individual herders and religious specialists who might know herbal or spiritual remedies for one or a number of animal diseases, or who might be locally renowned for their knowledge of husbandry and herding strategy. In the non-project literature, Nicolaisen (19[illegible]) and Bernus (1981) are excellent sources of information on Tuareg veterinary and husbandry matters. For the NRL, Maliki (1981b) has written an extraordinarily well-informed monograph on WodaaBe veterinary and herding knowledge. The care and treatment of pregnant and lactating females and of new-born animals are discussed. Forty-six different diseases (known by 65 terms) are idenfified by their WodaaBe names, the symptoms and causes they recognize, the frequency or severity of the malady, and the treatments they give. Sollod also reports that at least Tuareg do their own post-mortem examinations of livestock deaths to determine causation (Sollod 1981h: 33), and have firm notions of contagion (Sollod 1981a: 12), the relation between nutritional stress and disease susceptibility (1981h: 30-31), and other scientific matters.

These potential steps in gathering information and in support of government veterinary services have led to a more direct response to Livestock Service requests for assistance in building up veterinary outreach capacity. In mid-1980 the NRL was asked to supply consultant services to evaluate laboratory facilities and to investigate the causes of the widespread respiratory ailments that were afflicting small ruminants in the project zone. The initial consultation made by Douglas Butchart, USAID/Washington Veterinary Advisor (Butchart 1980) highlighted the need for collecting epidemiological data at a level of detail comparable to that being achieved for socio-economic and range questions. Following up this recommendation, the NRL retained a consultant during 1981 to advise the NRL on parasite problems, small ruminant mortality, and general disease prevalence; on training, data-gathering, and institution-building needs in the Livestock Service; and on the design and strategy for an animal health component of a possible NRL second phase. The report of this consultant, Dr. Albert Sollod (Sollod 1981a through 1981h) form the basis for the following summaries.

H. GENERAL VETERINARY OBSERVATIONS

Among the most interesting information provided by Dr. Sollod concerns general veterinary health conditions in the project zone. In contrast to many earlier observers, Sollod suggests that:

(1) Parasitic infestations are not nearly so serious as previously suggested (Sollod 1981h: 85-88). Internal parasite surveys during the rainy season of 1981 yielded "no indication of heavy parasite infections in any class of livestock," and external parasites are said to be at levels where individual animals can be treated by their owners, but not where dipping, tick control, or other general measures should be attempted. Mite-borne diseases were of most economic significance, and recommendations are made on appropriate treatments.

(2) The major diseases occur mainly in localized areas and/or in brief outbreaks. The localization of health threats means that veterinary personnel would benefit from long postings to particular sites to develop their awareness of and responsiveness to the local problems. Second, localization implies that few additional general campaigns against particular diseases are called for (in the way that, for example, additional continent-wide campaigns against human childhood diseases may soon get under way). Among the fourteen "diseases of greatest economic importance" identified by Dr. Sollod, two (CBPP and rinderpest) are already kept under reasonable control, while only two others (brucellosis and small ruminant pest) should be made the subject of general control campaigns (the first by herders themselves, the second by the veterinary service) (Sollod 1981h: 49, 13-14,27).

(3) Put most generally, veterinary health conditions in the pastoral zone are not extremely menacing. Sollod does not make any such blanket statement, but a reading of his observations (made disease by disease) points to the probable ability of herders themselves to treat or prevent many diseases if supervision and especially pharmaceutical supplies were adequate. What needs to be built is the chain of information and supply to the individual herder with the sick animal or outbreak in his herd. Additional capability for the military-style sweeping cross-country campaign is much less necessary (excepting as noted for small ruminant pest).

C. PARTICULAR VETERINARY DISEASE STRATEGY

Sollod's approach to veterinary medical intervention proceeds from the twin convictions that livestock owners can treat most problems themselves, and that treatment should be clearly economically

justifiable - one major test of which is the herder's willingness to pay for the treatment, or at least for the medication. In his final report and its annexes, therefore, he seeks to present practical strategies for dealing with particular diseases. Regouped here from various places in the report is a summary table that arrays Dr. Sollod's observations and recommendations on the diseases of greatest economic importance in terms of lost production, mortality, public health menace, and estimated cost of control.

Several comments on this summary table should be made. (1) There is a certain weighting in the list toward small ruminants, in part because cattle diseases are under better control and threaten less, and in part because Dr. Sollod was asked to focus especially on sheep and goats. (2) Herd-level treatments appear in nearly all cases because the most "economically important" diseases are precisely those which most threaten entire herds. (3) In some cases the treatments recommended are not those currently accepted by the veterinary authorities in Niger. Sollod's text discusses the differences, and suggests when trials should precede general adoption. (4) Sollod clearly recognizes that present Nigerien government policy is against herders injecting their animals. In another report, he points out the advantages of having them do so (Sollod 1981g: 16-17). The recommendation that the herder learn to give a number of injections is thus the best strategy, according to Sollod, but interim procedures by which the veterinary agent gives injections may also be tenable. (5) We have not here summarized the parallel information for diseases of "lesser" or "uncertain" economic importance in Sollod's terms. One additional point that such summaries would show is that some of the more general medicines (oxytetracycline, clostridial vaccine, levamisole) are effective against several diseases. (6) Finally, it should be noted that field conditions in Niger and the short-term nature of the consultancy limit the temporal, geographical, and statistical thoroughness of Dr. Sollod's observations (field work was from 29 April to 24 May and from 1 August to 30 August 1981). Sollod is tentative in his conclusions, and the actual frequencies and economic severity of the various diseases remains to be further confirmed.

MAJOR VETERINARY DISEASES AND TREATMENTS FOR CENTRAL NIGER: A SUMMARY

Disease Diseases of greatest Economic Importance	..affects (mainly)	...threatens and should be treated at the level of individual animal	herd	..is treatable with the medicine	Treatment Should be Given By: The Herder Orally	By injection	Vet Agent	Vet Campaig
• Anaplasmosis	cattle	X		long-acting oxytetracycline		X		
• Avitaminosis A	cattle		X	Vitamin A		X		
• Blackleg and Malignant Edema	cattle		X	Multivalent clostridial vaccine		X		
• Bovine pleuro-pneumonia	cattle		X	CBPP vaccine (live)				X
• Brucellosis	cattle sheep, goats		X	Brucella vaccine (live) (new reduced dorage)			X	
• Enterotoxemia	sheep		X	Multivalent clostridial vaccine		X		
• Foot and mouth Disease	cattle		X	FMD vaccine (live) - Vaccination only questionably economic				
• Nodular worm Diseases	sheep, goats		X	Oral levamisole, or ivermectin (?)	X			
• Ovine pneumonia	sheep		X	Pasteurella vaccine(?) or long-lasting oxytetracycline(?)		X		
• Small ruminant pest	sheep, goats		X	Rinderpest vaccine (live)		X		
• Protein/caloric inanitian in sheep	sheep			--				X
• Rinderpest	cattle		X	Rinderpest vaccine (live)				
• Salmonellosis	all classes		?	Anti-diarrheal bolus	X			
• Sheeppox	sheep		X	Long-lasting oxytetracycline or vaccine (live)		X	X	

Source: Data from Sollod 1981b: Annexes H, A, E, and text

D. A GENERAL APPROACH TO VETERINARY INTERVENTION

Already mentioned in passing have been several aspects of the NRL veterinary consultant's approach to interventions. These points may be summarized as follows:

(1) Animal health is part of a total environment, all parts of which affect health conditions and the likelihood of improving them.

(2) The goal of increasing productivity should determine the priority of attack on health problems - returns to investing in particular treatments or more general strategies should play an important role in veterinary policy formulation.

(3)A focus at the level of the herd is a prerequisite to sound health planning (Solod 1981b: 35). As with human populations, treatment of disease on a case-by-case basis can be a costly and futile strategy. Research and training guided by a focus on decreasing morbidity and mortality on the whole herd will be pursued differently from that focussed on the individual animal. Preventive medicine, treatment for subclinical symptoms, and triage will all play their roles at the herd level.

(4) Careful attention must be given to the elaboration of the entire system of lowest-cost veterinary health delivery. At one end this requires a capacity to evaluate, import, or manufacture appropriate medicines, while at the other end it means giving livestock owners and managers - who obviously have the greatest vested interest in onsible care of their animals - the greatest possible role in that care. The design of such a system logically precedes discussion of how best to organize or augment government's own role in veterinary health surveillance and delivery.

(5) Adequate delivery also requires sensitive knowledge of actual production systems and constraints and of variations in disease levels at different times of the year and in different locations. Only this research-based planning will ensure that the right medicaments will be in a veterinary auxiliary's bag, for example, or an expectable seasonal elevation in the incidence of one disease or another.

E. NRL CONTRIBUTIONS TO THE ORGANIZATION OF A VETERINARY HEALTH DELIVERY SYSTEM

1. Secourism.

The NRL project team has contributed in concrete ways (beyond research alone) to the effective delivery of veterinary health services. During the first half of 1981, members of the NRL socio-economic team organized a program of training for veterinary "sécouristes" (auxiliaries) in the Arrondissement of Tchin Tabaraden, under the auspices of the regular arrondissement veterinary service. The governing idea is to build downward - to devise a system for delivering medical services to the herders wherever they are. Briefly training members of pastoral communities in western veterinary methods of dealing with some ailments, equipping them with veterinary supplies, and supervising them in the field are seen to be the major elements in making such a system durable and effective. Since distances between official veterinary posts can be up to 150 kilometers, a dispersed network for delivery of services in the bush is vital if herders are to receive any attention at all outside the annual CBPP and rinderpest vaccination campaigns.

The system is based on the model of the system of auxilliaries or "secouristes" developed for human health in Niger over the last twenty years. Recruits are to be ordinary members of the communities they will service, to receive such brief training as will not alinate them from their fellows, to be trained in a limited range of services and to refer others to higher levels, to work without pay (except a small mark-up on the medicines), and to remain wholly outside the civil service structure.

Twenty recruits were identified and trained in April 1981, of whom sixteen were from nomadic communities. Ten days of practical training was given, and the veterinary secouristes were sent back to their communities. The NRL Evaluation Report discusses the strengths and weaknesses of the first round of training and the subsequent supervision. Supervision at work proved much more difficult than simple resupplying and discussions on market days. But within a month the auxiliaries had treated over 3,000 animals. And the NRL had scored an immense positive response in the herding communities (cf. Mouhamadoune 1981).

There is no doubt that such a set of auxiliaries can be effective: it is much more difficult to design the system of supervision and supply in such a way that will keep the system in operation in a cost-effective way. The problem of compensation (monetary, psychological, or otherwise) is a tough one, since it is part of the same much more extensive problem with human health auxiliaries.

III. ANIMAL NUTRITION

A. BACKGROUND

The range management section of the NRL team focussed its work on manipulating the relationship between livestock and range vegetation for maximum livestock production goals. Beyond the grazing trials it has undertaken, the team has taken some tentative steps to examine questions of animal nutrition independently of, or at least supplementary to, questions of range grazing. This short chapter similarly reposes the question of nutritional aspects of livestock productivity independent of range production in order to summarize material gathered by the NRL and in other projects.

In general, the NRL project team has not engaged in the intensive examination of livestock nutrition. No laboratory facilities for the analysis of feed composition and value were established, and the grazing trials have seen the animals as a kind of black box through which range grasses are put, with the outcome in animal growth measured. Further, for reasons discussed in the 1981 NRL Project Evaluation Report, the technical adivsory position in animal production was never filled, and certain pilot activities in nutrition called for in the Project Grant Agreement (with feed supplements and minerals) have not been carried out. Nonetheless, the current understandings within the Project on nutritional matters are worth reporting briefly. These considerations may be categorized as having to do with (A) energy supplies, (B) protein, (C) mineral intake and vitamin supplies. Though vitally important, systemic relations among these factors, and others such as water intake, disease, general condition and thriftiness, cannot be explored given the lack of project attention.

B. ENERGY SUPPLIES

1. Energy Intake.

The conditions under which Sahelian animals thrive are not nearly well enough documented, either before the NRL or because of it.

Neither the nutritive intake regimes of particular species and breeds, nor the conditions of their transformation and utilization of energy are known in detail. The Production Primaire au Sahel Project in Mali (PPS), now about to publish its major results, will give us data at least for one livestock producing region. The herd dynamics study being undertaken by the NRL in 1982 will begin to outline conditions in Niger. Other nutritional data comes from the atypical conditions (frequent watering, good veterinary care, low grazing intensities) of experimental stations like the ranch at Toukounous in southwestern Niger.

In gross terms it can only be repeated that energy intake in pastoral conditions is sufficient for cattle to achieve full adult weight only after four years; that sexual maturity is at three years; that environmental stress causes high losses from the combined effects of heat, the need for extensive walking, disease, and water and nutrient deprivation; that calving ratios are low (around 50%), calf mortalty high (about 20%, although the NRL veterinarian suggests this figure may be too high (Sollod 1981h)); and that generally parallel conditions exist for other livestock species.

The distribution of the severest stress varies during the year. In the rainy season, despite the long transhumance routes, energy intake is sufficient for the "normal" patterns of growth and maturation to occur (although there may be some initial weight loss after the beginning of the rains since animals have adjusted to dry season conditions). It is in the dry season; on the other hand, that stress is greatest. The Project Paper cites a French study from the 1960s which reported that 20 per cent of Tuareg cattle mortality and 37 per cent of Peul (Fulani) cattle mortality were due to heat stroke. Camps may be as much as 20 kilometers from water, with cattle being led to the water only every other day. Calving season is generally skewed toward the end of the dry season; so that dams and calves can gain strength for rainy season transhumance, but with the cost that the final weeks of gestation occur during the period of heaviest eco-systemic stress. In general, animal weight loss over the dry season may be up to 8 to 10 percent of total body weight. In these circumstances, it is obvious why indigenous animal breeding

selects for hardiness and endurance as well as for milking capacity and reproductive potential (Maliki 1981b: 105).

The progressively stressful conditions of the dry season put both people and animals at risk. For those animals that are pregnant, weakened by illness, old, or very young, the risks are especially high. When drought conditions every four to five years aggravate the effects of this "normal" stress, disaster frequently ensues.

2. Intervening to Increase Energy Supplies.

It is to find ways to counteract the double cycles of annual dry season and periodic drought stresses that research on animal nutrition is oriented. To guarantee energy availability for livestock, three lines of work have typically been followed: (1) the creation of grazing reserves; (2) the preservation of nutritious feeds by haying or silaging; (3) destocking. Methods for each of these stragegies can be sought for routine annual needs or at the level of "drought-proofing."

(a) Grazing reserves. Reserving areas for later grazing has been a common but rarely successful feature of livestock projects in Africa. Resting large areas for a whole year may only increase grazing pressure elsewhere, while non-preferred species may assert themselves in the vegetation community. Government programs to reserve pastures for the dry season tend to choose moist lowlands that appear very green, but at the same time take the land out of pastoralists' hands, with an effect much like losing land to cultivators. Grazing reserves chosen, or closed and opened, without careful articulation to pastoralists' normal transhumance patterns, can simply be irrelevant to their needs and therefore unused. So the pitfalls of grazing reserve systems are many, and as Pratt and Gwynne point out (1977: 112-121), even where practicable must be designed only after substantial knowledge of the rangeland and its utilization has been accumulated.

As mentioned in the chapter on range management, the NRL is experimenting with deferred grazing for the first time in early 1982. Paddocks left closed until March, April, and May respectively will

measure how much nutritional value remains in areas left ungrazed that long into the dry season.

In the only significant experiment in Niger with deferred grazing, Klein, Keita, and Mesnil (1981) found that walking time and watering frequency had a greater effect on dry season animal weights than various routines of grazing rotation. They are also led to the conclusion that deferred grazing can only have utility if it is integrated into complete management systems.

(b) Fodder conservation. The production and conservation of hay and/or silage can be ways of preserving the higher nutritional value of plants before their seed has set. Stored for dry season, or drought use, hay and silage can regulate feeding routines by taking unneeded feed from the abundant rainy season range and then using it for dry season supplementary feeding. Simply letting it stand on the range leaves it neither as digestible or as nutritious.

Nigerien pastoralists have knowledge of hay-cutting, since the markets they visit often have for sale bundles of grass cut at ponds and elsewhere, and sold especially for town-kept horses, donkeys and work oxen. That they therefore do not cut hay for their own animals suggests that they have problems of labor availability, of storage safe from pests or thieves, or of the actual marginal value of cutting hay versus leaving it to stand.

Some experiments in hay-making have been carried out at Toukounous Ranch by livestock specialists in the Livestock and Veterinary Research Laboratory in Niger. NRLs' Technical Staff Assistant, Bud Rice and other range research team members have tried cutting (with scythes) and storing (in the open) two stacks of hay. One stack, stored without further preparation, was badly attacked by insects. The other, stored on ground treated with insecticide, fared better.

In short, some attempts to preserve fodder have been made at a level of effort possible for the individual herder. Systematic proving out of feasibility has yet to be done. Meanwhile, it has also been remarked that perhaps large-scale, mechanized haying could be undertaken either for laying in feed against the possibilities of drought, or on a more limited scale for dry season distribution to animals at risk. The costs and benefits of such operations are unstudied.

(c) Destocking. Casual observers have sometimes suggested that dry season or drought losses could be stopped by timely destocking of the rangelands. The argument is usually couched in language that suggests again the "irrationality" of systems that stock at any higher levels than can be carried through the average drought that can be expected every four or five years. Are the herders rational? New research done in East Africa is beginning to demonstrate the economic rationality of boom-bust strategies of livestock investment. Indeed, it suggests that the wider the oscillations between wet season range abundance and drought stress, the more sense it makes to stock at high levels and hope that drought holds off for one extra year. Besides, NRL research reported in the chapter on range management suggests that locally heavy grazing may be good management strategy. It is also true that normal dry season weight losses are compensated quickly during the rains, so that the time at which adult weight is achived is not significantly delayed. These research reports at least open the possibility that the sight of thin animals losing weight in the dry season, or of animals dying or being sold at distress prices in drought, are visions of rational economic adaptation to rangelands. Ideas for destocking should be put aside until research is undertaken on these points in Nigerien conditions.

C. PROTEIN SUPPLIES

1. The Acquisition of Protein.

Ruminant animals do not need high quality protein in their feed. In the rumen are bacteria which use nitrogen from the grazing to build high-quality protein in their cells. The bacteria break down the complex carbohydrates of cellulose that are hardly usable by non-ruminant species, and thus harvest and transform energy for eventual human consumption that would otherwise go unused. Since the cellulose content of range fodder is highest in the dry season, ruminants need specially high vegetable protein supplies than in order to keep the bacteria "at work". The bacteria themselves are digested later in the animal's digestive tract and yield their proteins to their host's needs to grow, maintain tissues, and produce milk.

Of course Nigerian herders do not recognize protein as such, although in an evolutionary sense their animals do by selecting from a mix of species or from individual plants those more succulent species or plant parts that have higher protein content than the others.

> Bremen (1981: 11) cites exacting field work in Mali by the PPS team that shows that the protein content in the herbage actually grazed was 2 to 5 per cent higher than the average protein content of the pastures in which the animals were grazing.

Nonetheless, the herders have their own knowledge of the forage value of the plant species and recognize as well the difference between appetability and forage value.

> Maliki (1981b: 65-75) gives WodaaBe views on seventy-one species, the animals that seek them, and the forage values - which vary by season - that WodaaBe recognize. A cross-check with the agrostological studies (Rippstein and Peyre de Fabregues 1972) indicates a high correlation between WodaaBe and Western scientific views. Discrepancies could point to interesting research problems. Bernu (1974: 78-80) reports on Tuareg grazing preferences.

2. Intervening to Increase Protein.

Aside from indigenous methods of maximizing protein by moving animals regularly to the newest growth or by burning, there are four possible strategies of outside intervention to increase protein supplies. First, one can attempt to increase the production and growth of protein-rich species *in situ*. As noted, the NRL range management team found that some species of higher protein content increased when heavy grazing was applied to pastures dominated by less valuable species. Reseeding experiments with indigenous species have also been suggested from time to time, but it is doubtful whether seed banks of such species have yet been built in the Sahel. Experiments with raising forage under irrigaiton have been attempted in Niger (see Klein, Keita, and Mesnil 1981), but so far without results worth extending. A second method to increase protein is to import exotic forage varieties and propogate them in Niger. In the forage trials of Klein, Keita, and Mesnil some Sudanian species were included. In Mali some experiments with intercropping forage (cowpea or niébé) with millet have been attempted. NRL range managers tried growing a dryland legume, *cicer*, but have not yet reported the results. A third means of increasing protein is to import protein-rich feed supplements into the zone, either from agricultural areas to the south in Niger or from elsewhere. Some cotton seed (from

Nigeria as well as Niger) is already available at dry season markets in the zone and is used by herders for at-risk animals. Other agricultural residues, such as legume hay or groundnut cake, do not appear to move to the pastoral zone. Fourth, high protein levels of existing forage can be stored by silaging. The NRL has dug some crude pit silos and stored grass (as "haylage")in them, late in 1981. The pits are being opened one at a time and the state of conservation and palatabilty observed. Again, no results are yet available.

At the level of disaster-proofing, policies might be directed toward the cultivation or storage or contingency planning for large supplies of protein-rich feed supplements. The technical parameters of such mechanisms as extensive calf salvage programs, drought silos or cow-calf forage farms have never been examined. But it is fairly safe to suggest that some such strategies, aimed at making protein supplies available at least to the animals at hightest risk, would be cost-effective in terms of insuring a floor for livestock production in the country at large.

D. MINERALS AND VITAMINS

Since no feed analysis for livestock in the project zone has been undertaken, this section is meant only as a note of reminder.

Salts important to animal production are distributed highly unevenly in and beyond the project zone. Areas of salin earth and water are found especially in the northwestern part of the zone, to which a large proportion of the animals are driven, as the rainy season progresses, for the cure salée. The cure occasions major social and cermonial gatherings, but it is also a major means of reconditioning the animals (and apparently of purging and deparasitizing them).

For livestock that does not transhume to saline areas, and for all livestock at certain times of the year, salt blocks from several Sahelian sources are available in the markets. The I.E.M.V.T. agrostological study gives analyses of these local salts (Rippstein and Peyre de Fabregues 1972: 209-120), as well as of the mineral

contents of the vegetation normally grazed by the animals (pp. 205-208). On the other hand, no specific mineral deficiencies have been identified as being of importance either to the livestock in general or to particular afflicted animals. Vitamin deficiency, and specifically Vitamin A deficiency in the dry season, has been identified both by herders and technicians as a major problem in the zone (affecting up to 40 per cent of the cattle in some areas during 1981). Avitaminosis causes night blindness among both cattle and people (see Human Health chapter), and cattle mortality often ensues. Treatment is easy with oral or injected Vitamin A, and although it is not always clear to herders that they should do so, the entire herd should be treated since subclinical symptoms are likely to be present in all the animals that have shared grazing. WodaaBe identify a zone north of the line between Tchin Tabaraden and Aderbissinat, passing by In Waggar and Tamaya, as one in which night blindness is particularly likely to occur: they also believe that the lack of good aerial pasture, particularly the shrubby species Boscia senegalensis and Maerua crassifolia (both superior dry season forages rich in protein, according to Rippstein and Peyre de Fabregues 1972: 200-203), may be responsible for the condition (Maliki 1981b: 79-80). The NRL team helped demonstrate to herders how simple the remedy can be, when several cows were cured almost overnight by the administration of cod liver oil.

Further thought should be given to the introduction of mineral supplements only against the background information now known about the availability of minerals through local commerce, and the serious Vitamin A deficiency identified by the project. The importing of mineral blocks, for example, may be unnecessary, and it may compete with local commerce. Making Vitamin A available would appear a sounder contribution.

IV. WATER SUPPLY

A. INTRODUCTION

Water and pasturage are the two central resources around which the pastoral production system revolves. They condition most aspects of this system - determining the types of herd movement which are undertaken, influencing herd size and decisions about herd composition, providing sustenance for animals and thus for human beings - in short, water and pasturage permit pastoral production to continue, and the amount and distribution of these resources determine what shape this production takes. These resources, however, also act to constrain pastoral production insofar as present limits to their availability impede increases in production levels and productivity.

The quantity and quality of water provides a major key to pasture utilization. Consequently, research on the nature and use of the project zone's water supplies is particularly important, since it provides the data base from which interventions to improve water supplies or to better articulate water and pastures can be planned. The first section below discusses what project research has learned or is learning about the distribution and use of water sources in the NRL zone. The second section deals with the issue of the "adequacy" of these water sources. Finally, we will examine some suggested interventions.

B. EXISTING WATER SUPPLIES

1. Types of water sources.

Types of water sources found in the project zone can be divided into two categories: temporary and permanent. In the former, there are three types: 1) water flowing in watercourses during and immediately after the rainy season, 2) temporary ponds (mares) which catch and accumulate runoff during the rainy season and persist for some weeks or months into the dry season, and 3) shallow temporary wells (puisards) which are dug in pond sites and watercourses after the surface water is exhausted. Among the "permanent" water sources

(they, too, can dry up eventually), four types have been identified: 1.) traditional wells, built by itinerant Hausa well-diggers and the most common kind of permanent water point, 2.) large diameter cement wells constructed by the Nigerian Ministry of Hydraulics, 3.) dry holes (forages) and artesian wells, and 4.) springs (Knight 1981b: 1).

2. Geographical Clustering of Types.

The frequency of each type of water source varies by region according to a number of factors in term of temporary water points. The distribution of surface water is conditioned by both the absolute amount of rainfall and the geomorphological characteristics of the given area. Surface water is of particular importance in the rainy season and where permanent water sources are scarce. Traditional well construction is undertaken where the water table is not so deep and the geological profile not so difficult as to make the undertaking either dangerous to the digging teams or ultimately unfeasible since the well would be likely to collapse. If the area seems to be suitable for a traditional well, a herder or herders contract a group of well-diggers to build a well for an agreed-upon price. Where traditional well construction is not possible or the need for high capacity watering points is apparent, the Office pour le Developpement des Zones de Pour-nol (OPEDES) undertakes the considerably more expensive construction of cement wells or bore holes. The type and method of well construction have implications for the social aspects of water use, which will be discussed below.

To assess the distribution and types of water points and the inadequacy of existing water sources, two studies have been undertaken: 1.) an intensive water point survey in several areas of the zone (coordinated by TEA Jim Knight and section counterparts Issoufou Zangui and Oumarou Alpha), and 2.) one component of the aerial survey conducted for the NRL by the International Livestock Centre for Africa (ILCA). The water point survey studies several aspects - both physical and social - of water sources and water use in the NRL zone, and its findings will be referred to in subsequent sections. An impressive amount of empirical data has been collected, though

it has not yet been systematically analyzed and arrayed on maps. Here it is important to note that the study found a significant level of variation between areas in terms of dominant water types, capacity and level, and intensity of control (Knight 1980c: 2). The aerial survey begins to create a more general picture of water sources in the zone, though methodological problems, primarily the fact that the usually small size and localized nature of water sources meant that they were not often encountered within the sample strips of the aerial survey, necessitate that the findings be corroborated with maps and by ground truthing in order to improve their accuracy (Milligan 1981: 18).

The aerial survey's preliminary findings - subject to correction and/or elaboration - are as follows:

- water sources occur throughout the survey zone, though they are relatively rare in the north-eastern region around Agadez.
- the greatest concentration occurs between Abalak and Tchin Tabaraden and toward the east of Tassara.
- 58% (and possibly more) of the observed water sources were small hand-drawn wells. These are also the most widely distributed type of water source.
- the area of numerous small puisards tended to correspond to the sand dune/mare system and were most abundant in the Abalak to Tchin Tabaraden region.
- larger wells were found throughout the zone except in the north-eastern regions.
- open surface water is concentrated in the south-west between Tahoua and Abalak, with one large lake near Tahoua. (Milligan 1981: 18 and 45)

2. Water Availability and Transhumant Movement.

Stated simply, seasonal variation in the availability of water and pasturage closely condition the pattern of transhumant movement in the pastoral zone of Niger. To a certain extent, the availability of pasturage is contingent upon the availability of water, since even the best pasturage is unutilizable without nearby water sources. This relation (and the possibility of modifiying it) has specific policy implications which will be discussed below. At this point we will confine ourselves to some general remarks about the link between water and movement.

First, the high level of variability in the amount and location of annual rainfall within the pastoral zone means that the quantity and quality of water and pasturage fluctuate greatly from year to year. To a certain extent, annual rainfall can be seen as the independent variable upon which the whole pastoral system rests, since this variable fluctuates widely. Flexibility must be built into the social and economic adaptation to an unstable environment. This flexibility is guaranteed by an abrence of private ownership of resources: instead, a system of use rights and de facto rules for determining access to resources exist which accomodate the varied circumstances which arise.

The second point is that, apart from annual variation in rainfall, seasonal variation in the availability of water conditions a relatively regular pattern of transhumant movement. This pattern is based on the necessity of timely displacement (and ability to displace) to take advantage of changing sources of water and pasturage.

John Sutter (1978: 22-25) divides the transhumant pattern, of which water availability is a central determinant, into five major phases:

1. June-July. Immediately after the first rains, herds concentrated around dry season wells begin to move toward pastures left untouched during the dry season due to lack of water. Water is now available in puddles and small ponds, and herds are moved to areas reputed to have adequate surface water.

2. July-August. When the rainy season is well underway, herders move to the northern pastures which are abundantly supplied with surface water.

3. End of August-early October. As the rains become increasingly infrequent and eventually stop altogether, northern water sources dry up and herders make their way southward, finding water in the larger ponds and occasionally digging shallow wells (puisards) in low-lying areas and river beds along the way.

4. Mid-October - January. Herders settle in to their dry season water sources which could consist of one or more of the following: private (traditional) wells, public wells, puisards and ponds or other surface water sources.

5. If a herder's water source and surrounding pasturage dry up, he enters a new phase. By April or May many herders are forced to find an alternate water source, usually a public cemented well, around which the pasture is often over-utilized. Frequent displacement in search of now-sparse pasturage is often necessary. (See also Maliki 1981b for details of Wodaabe movement strategies.)

We have simplified the transhumant pattern in order to be brief. It is equally important to consider the influence of the vegetative cycle, which the WodaaBe perceive as the central determinant of transhumant movement. Nonetheless, the availability of water - and through water, pasturage - in conditioning transhumant movement should be clear.

A third point concerning the influence of water on human and animal movement is related not to the availability of water but its quality. Herders recognize variability both in the relative level of pollution of water points and in the chemical qualities which affect animal digestion and milking (Maliki 1981b: 42). A herder will attempt to move his animals if the quantity of water may be detrimental to herd health, although his ability to do so depends on the availability of alternative water sources. This issue will be further discussed below.

4. Social Aspects of Water Use.

As mentioned in the previous section, annual and seasonal variations in water availability require flexible social arrangements governing access to water. In theory, two possible situations exist: 1.) with government-constructed cement wells and bore holes, and with surface water, access to water is not controlled, though the availability of surrounding pasturage places some limits on the number of herds/animals which can be adequately accommodated by a given water source, and 2.) with privately-owned wells, the owner or owners of the well possess some right to determine who can use the well, and in what order, though this seldom means that another herder is flatly denied access to water. Acquisition of a well results from inheritance, purchase from another herder, or contracting a team of well-diggers to construct the well (Zangui 1981b: 2).

Examples from the water point survey indicate the variety of possible water point types, capacity and level, and intensity of control (Knight 1980d: 1-2):

- North of In Gall, there was an abundance of public, high-capacity water points. With these water sources being government constructed, access to wells was not subject to control.
- South of Agadez, there was a mixture of private and public wells of varying capacity. Use of private wells was relatively

tightly limited to members of the owner's lineage.

- In the valleys north of Dakoro, almost all water points were privately held, middle-capacity wells. Access to them was controlled by the proprietor but was relatively easily granted on a temporary basis.

Thus within this sample, there are varying degrees of control over access to water: no control, tight control over traditional wells, and a system for determining access without strongly exercised control. The degree of control exercised is related to the availability of water; as water becomes less available, control over access becomes increasingly tight. This trend seems to be true both seasonally - as water sources decline as the dry season proceeds, control may become stricter - and geographically - in areas where water is scarce, access may be more limited.

Access is first granted to members of one's fraction or tribe, then to others who request permission to use the well from the proprietor. Permission is rarely flatly denied (Sutter 1978: 29 reports that well owners say it would be difficult to refuse a request from a passing herder, perhaps because the herder's predicament is so well understood), but the herder could be put at the end of those wanting to use the well in certain areas; however, owners impose fees in cash or in gifts of animals. In the Tanout area, Sutter (1978: 29) encountered herders who said they paid well-owners 1500-2000 CFA to water their animals for the duration of the dry season (one reported paying 4000 CFA to use a well for three months). Similarly, during the water point survey at Aderbissinat, Oumarou Alpha Noma (1981c: 2) encountered a situation he found unusual for two reasons:

> (On one hand), of the wells surveyed, 55% belonged to Tuareg while 45% belonged to Fulani .... (On the other hand), during this survey, for the first time, I encountered a completely private well. This well belonged to a Tuareg who charged other herders for the right to water their herds at his well, the fee ranging from 5,000 CFA to a certain number of animals or a certain amount of tea or sugar per year or per person depending on the means of the herder .... I should indicate the fact that, in this region, the Fulani and the Tuareg do not coexist particularly well in most cases. In fact, in one conversation, a WodaaBe herder told me that certain Tuareg well-proprietors systematically prevented the WodaaBe from using their wells.

Although the water point survey found that the practice of charging a fee for access to a well is not widespread, there are differing opinions on this subject. It would be interesting to know to what extent it occurs and under what circumstances. Analysis of the well-point surveys may yield this information.

5. Ethnic Specialization.

Oumarou's observations show that there are ethnic differences in water use, particularly in terms of the types of water points exploited by Tuareg and WodaaBe. It should be noted, however, that there is variation within as well as between ethnic groups.

In general, the WodaaBe tend to use the public cement wells and tend not to privately own traditional wells; the case mentioned by Oumarou is thus a notable exception. The usual explanation for this is that the WodaaBe are relatively recent arrivals in central Niger, which has traditionally been Tuareg territory. Nonetheless, it is not entirely clear why this has prevented more WodaaBe herders from building their own wells or purchasing them from existing proprietors, since there are recognized problems with using public water sources (overcrowding and associated overgrazing of surrounding pasturage, poor sanitary conditions in and around the wells, etc.). Several factors may contribute to an explanation. For the WodaaBe herder, the existence of universally accessible public wells (even with their associated problems) coupled with relatively open access to private wells, reduces the incentive to invest in the construction or acquisition of a private well, at least in the short term. There is also the fact that the WodaaBe are still perceived - both by themselves and by the Tuareg - as guests in the region; thus, well-digging might be seen as inappropriate or as a form of aggression. Third, Fulani cultural strategy has always placed a high value on the capability for instant mobility, and in this light sinking a well would mean tying oneself down. Finally, financial constraints are sometimes cited as a reason for not building a well.

Whatever the reasons, WodaaBe reliance on public wells has certain implications. First, it contributes to their tendency to displace more frequently than the Tuareg in search of water sources where the surrounding pasturage is adequate. This means that the last phase of the transhumant cycle as identified by John Sutter (the end of the dry season) may be particularly stressful for some WodaaBe

herders. Second, WodaaBe herders do not rely exclusively on public water sources but also request permission to use private wells, usually owned by Tuareg. Similarly, Tuareg sometimes use public wells, though they prefer not to do so. This implies a level of interaction between the two ethnic groups which occasionally leads to tension and hostility (and sometimes open conflict), as noted above by Oumarou Alpha. Examples of inter-ethnic conflict over water resources are frequently mentioned in the literature but it is difficult to estimate its seriousness, given that there is also a high level of peaceful coexistence and sharing of resources. While TSA Jim Knight (1980c: 2) maintains that "ethnic competition for either pasture or water is not a salient feature of the NRL zone", TSA Cindy White (1980b: 5-6) reflects a more common opinion when she says that "(inter-ethnic) conflicts around wells are acute enough and occur often enough that the WodaaBe are anxious to have private wells and are willing to contribute money or labour to their construction." Clearly, this situation is not well-understood: it would be wise for the NRL staff to clarify this issue since policy matters are at stake both at the lower level of water point construction and at the much higher level of inter-ethnic cooperation and competition.

6. Traditional Well Construction.

One aspect of the water point survey was a study of traditional well construction, conducted by Issoufou Zangui (1981c). Well construction is carried out by Hausa well diggers (a team of 5 to 10 men) whose main occupation is mixed farming but who engage in well construction during slack periods in the agricultural cycle. The team undertakes the construction of a well after conducting an evaluation of the site and negotiating a contract with an interested herder or group of herders. The price of the well depends on several factors - the geomorphology of the region, the going rate for a well during a given year (related to the supply of and demand for services), the size of the team, the length of time required to complete the well. One interesting finding of the study is that there has been a steady and rapid increase in the price of well construction.

Zangui (1981c: 5) reports that a well 18 taddiés deep requiring two months to build cost 40,000 CFA in 1976: a well of similar depth which took 40 days to build cost 90,000 CFA in 1978, and a 19-taddié well taking 2 months to complete cost 160,000 CFA in 1980. The explanation for this fourfold increase in the space of four years is not clear, though the rapid pace of well construction since the drought (Knight 1981b: 2) suggests that strong demand for this service has brought about an increase in its price.

7. Quality of Water.

As suggested above, the quality of water sources, as well as their availability, is an issue to take into consideration. Although no specific study of the quality of water sources in the project zone was done, three points can be made here. First of all, certain water points are particularly valued for their quality, namely their mineral content. This is the case with the water points in and around In Gall, the region of the 'cure salée' which the herders maintain exerts a strong positive influence on animal health. Conversely, herders will avoid water sources known to contain mineral concentrations which would exert a negative influence on the health of their animals. For example, Sutter (1978: 2) mentions that water sources containing high concentrations of natron must be avoided during the first rains since animals have not yet adjusted to newly sprouting grasses and at that point cannot ingest large quantities of natron. Finally, herders will attempt to avoid or move away from water sources which appear to be polluted to protect both human and animal health. The problem of pollution is most pressing at temporary water points and overcrowded public wells where sanitary conditions ar often bad. Louis Loutan explains the effect of people and animals sharing the same water sources on human health, though the implications for animal health are also clear:

> Although Wodaabe prefer the clear water of the boreholes, they are usually constrained to drink water from wells or ponds. During the rains, ponds are the major source of water. There (as at the wells) animals come before people. (While watering), the cows walk in the water, therby dirtying it, though this is not the case with goats and sheep which drink at the edge of the pond. Women seek out clean ponds, even if it means going a few extra kilometers. They draw water where it is clearest - among the pond grasses in zones where animals have not passed. However, often (especially at the end of the rainy season), water is

> dirty, muddy and sometimes polluted with animal urine and excrement. The WodaaBe find drinking this water repulsive, but are forced to do so. (1982: III)

Obviously, such points of contact contribute to the transmission of disease and parasites between animals and between animals and people. Moreover, as Dr. Loutan notes, while herders are aware of these problems and try to move their herds to avoid them, they often have no alternatives. In sum, seeking or avoiding water of a particular quality influences herd movement decisions, though the extent of this influence appears to depend on the availability of other water sources.

C. THE ADEQUACY OF WATER SUPPLIES IN THE NRL ZONE

The foregoing discussion summarizes what project research has revealed about the distribution and use of water points in the NRL zone. The question which presents itself for planning purposes is, given what we know about water supplies, how adequate do they appear to be?

At one level, the water point survey has suggested that existing water supplies are relatively adequate in terms of present pastoral adaptation. The pastoral production system functions well, given the amount and distribution of water supplies presently available. Herders accept a given level of stress on their animals during the dry season. Herd movement and herd composition decisions are partially based on an assessment of existing water sources and are designed to make the best possible use of these sources, etc. That herders have this perception of the relative adequacy of water supplies is suggested by PCV Jim Knight who reports that herders "have not systematically identified a lack in total water supply or a poor distribution of water points as salient constraints on their use of pasture or significant concerns in their management decisions" (1981b: 1).

Nonetheless, the extent to which this adequacy is relative becomes clear when one takes into consideration the fact that any increment in water supply is rapidly incorporated into pastoral strategy. Thus, as more public wells are built, they are quickly put to use by herders already in the zone or attract more herders, particularly WodaaBe, into the zone. An even more recent example

is drawn from road-building activities in the past three or four years. Pits dug by the roadside to build up the road bed tend to fill with rain, and have come to be used by herders in much the same way as other kinds of temporary water points. These observations strongly suggest that, while existing water supplies may be adequate to meet the basic needs of present pastoral adaptation, this certainly does not preclude the possibility of making water supplies more adequate!

D. THE IMPROVEMENT OF WATER SUPPLIES IN THE NRL ZONE

To improve water supplies it is important, of course, not to proceed randomly or with respect only to hydrology and/or political pressure, but to base interventions on research geared to production improvement potentials. Four potential areas for improvement have been suggested and obviously link into other project efforts, particularly range management, animal health and human health.

1. Unlocking Underutilized Pasturage.

It was mentioned above that to a certain extent water provides a key to pasturage, since animals need relatively close water supplies in order to take advantage of even the best pasturage. The question arose during NRL planning whether there were any areas of pasturage presently unexploitable due to lack of water sources which would be unlocked if water points were constructed? Two sources of information exist which could contribute to an answer to this question. First, interpretation and corraboration of the data collected during the aerial survey should provide a macrolevel understanding of the herd-water-pasturage relationship and may, in the process, identify underutilized areas that would benefit from water point development. In fact, the aerial survey itself may be adapted to do visual reconnaissance of such areas. The second source of information is the material from the water point survey. This material is important both because it provides a great deal of detailed, microlevel data about the adequacy of water supplies and herders' perceptions of this adequacy and because it acts as a mechanism of groundtruthing for the aerial survey and other studies of larger scope.

Systematic interpretation and arraying (in maps and tables) of both sources of information is still forthcoming. The water point survey has identified some areas where there is a notable demand for additional wells which may serve as areas for project intervention. These areas include south of In Gall, and the areas around Kao and Abalak (Knight 1981b: 2 and Zangui 1981a). In all three areas, construction of traditional wells is expensive and difficult due to the nature of the geological profile.

> (Similarly, in early 1976 Marianne Rupp, a consultant to the project design, identified desirable areas west and south of Tiantoborok, east of Aderbissinat, northeast of Tanout and north of Marandet, none of which could be grazed for lack of water (Rupp 1976: 10). It would be instructive for NRL staff to retrace her steps to verify if these areas have been exploited since Rupp's visit.)

Project interventions to assist in water point development could take several forms, depending on the nature of the situation (Knight 1981b: 3-5). Where traditional well construction is not feasible, as in the cases mentioned by Knight and Zangui, OFEDES operations are clearly called for. Where traditional well construction is appropriate, it is seen as preferable for several reasons (lower cost, more rapid construction, more appropriate technology, employment generation). A suggested method of doing this is to allocate credit through the cooperative system to groups of herders (Socio-Economic Team 1981: 16), who would contract traditional Hausa well-diggers to construct a well. In short, additional water-point construction must be technically justified in terms of "unlocking" pasture, and must be done in socially and economically appropriate ways.

D. <u>Extending Herds' Stay in Northern Regions</u>.

Another possible area for improving water supplies in the project zone is extending the length of time herds spend in the northern regions. The Project Paper (1977: 69) originally recommended experiments with surface water development "aimed at finding ways of enabling herds to remain in the northern part of the pastoral zone for a longer period of time after the rainy season, thereby

reducing grazing pressure on the dry season pastures to the south; as many as three catchment areas were to be constructed, and the experiment was to be monitored by the range management team. This pilot intervention has not yet been implemented, though the 1981 NRI Project Evaluation team recently reasserted the viability of this scheme, referring to a successful example of a similar effort undertaken in Senegal (N.R.L. 1981b: 108 - 109). Thus far, NRI range analysts have not calculated the number of feed days which could be gained by prolonging the herds' stay in the north; this would provide part of the technical basis for assessing the feasibility of interventions of this sort. In addition, two other issues merit examination. First, even if herds could take greater advantage of northern pastures with surface water development, the question arises, would there be sufficient resources available to support them on their trek back southward? if not, would it be useful to examine the possibility of developing water points along major transhumant routes to minimize stress on the return trip southward? A second issue is whether or not a longer stay in the north would jeopardize herders' claims to dry season pastures. This factor may be important where sedentary herds (many apparently from Nigeria) have tended to move northward into areas traditionally occupied by nomadic herds during the dry season. Data are lacking on this point, too, but in general it appears as though a re-evaluation of the possibility of surface water development in the north is called for to ensure the viability of an integrated mobility strategy which improves pasture use and thus animal production without incurring offsetting risks.

2. Improving the Technology of Traditional Wells.

A third area for improving water supplies in the project zone consists of improving the technology of traditional wells. Three ways of doing so have been suggested, although, as in the case of surface water development in the north, no research has been conducted explicitly by the NRI to evaluate these possibilities:

a. Bore hole construction. The cost effectiveness of building bore holes to feed traditional wells is not entirely clear. Prima facie it would seem that this undertaking would be quite costly in terms of the benefits it would provide. Nonetheless, other projects in the pastoral zone are exploring this option, suggesting that the issue is not settled.

b. Improvements in tradition wells. Methods of improving traditional wells have been suggested, specifically mouth and tube reinforcement and apron construction. As in the case of bore holes, the cost of such improvements may not be justified if they do not sufficiently ease the utilization or extend the life of such wells. Nonetheless, Knight (1981b: 3) does mention two sites where well reinforcement might be useful to prevent rapid subterranean flow at the water table from causing the well to collapse. This suggests that, while the construction of boreholes and improvements in traditional wells themselves may not be of particular use on cost-effectiveness throughout the zone, there are certain cases where these interventions might be called for. The extensive literature in intermediate technology might usefully be probed for suggestions for the NRL zone, and the operations themselves might be undertaken by pre-cooperatives.

c. Water drawing. Drawing water is a time-consuming and arduous task, requiring great expenditure of human and animal energy. Mallki (1981b: 30) estimates that it takes three people four to six hours to draw water from a 40-meter well for a herd of 50 cattle, not including the time spent walking to and from the well. The task of drawing water is particularly hard during the dry season, when animal needs for water are highest; a study by Jeremy Swift estimates that the time required to water a herd of 25 cattle increases from 40 hours per man per month to 100 hours per man per month during May and June. This is also, of course, the period when herders are under the greatest stress as a result of an interaction of factors; in brief, this phase of the transhumant cycle is one during which energy expenditure and environmental constraints increase, while available energy intake does not rise to cover these increased needs. (See chapter on Human Health.) Clearly part of this stress would be alleviated if some socially acceptable and economically feasible way of reducing the time and energy herders must spend watering their herds could be found.

Apart from the human labor requirements, the task of drawing water from the wells also takes its toll on the animals used to pull the water from the wells. It has been noted that oxen or donkeys can be used for this task no longer than three years due to the constant stress put on their musculature. A method of preventing or reducing this stress might be to develop new forms of harnesses to redistribute the pressure borne by the animal.

4. Incentives to Particular Kinds of Herd Movement.

The fourth area for developing the project zone's water supplies concerns the provision of incentives to particular kinds of herd movements. To a certain extent, this is a more general statement of the priniciples behind the first and second areas discussed above; nonetheless, it deserves separate attention here, particularly because of its future implications. In essence, strategic water point development can be used to encourage herd movments in such a way as to alleviate pressure on overgrazed pastures, encourage the use of particular transhumant routes or contribute to the development of new ones, etc.

Various schemes fall into this category, apart from the two major ones mentioned above. For example, turning off boreholes at certain times in the year defers the use of surrounding pasturage until it is most needed. A similar principle provides the bases for TSA David Blaine's (1981b) suggestion of a grazing system based on an east-west division of an area of pasturage, each side with its own well; the herd would cream the grazing on one side, move to the other side for heavy grazing, and then rotate again to permit the second well area the delayed growth that may be stimulated by water retained in the soil after heavy grazing.

The important point here is that water point development can not only alleviate constraints in the present pastoral production system but can also form an integral part of improved range management techniques. By undertaking strategic water point development, the fundamental relationship between animals, pasturage and water might be altered in such a way as to increase the efficiency of resource use, thus improving herd productivity. At this stage, though, encouraging particular kinds of movements as part of a range management scheme remains more of an eventual direction to take than it is an approved section that will soon be put into practice. A great deal more needs to be learned about the resources of specific tracts of the project zone and the way in which their resources are presently utilised. Moreover, the formation of cooperatives, which would provide range management schemes with an appropriate social context and institutional base, is not yet underway; in any event,

herder cooperatives need time for experimentation and growth before they could be charged with the responsibility for introducing significantly improved range management techniques into the present pastoral adaptation (see chapter on cooperatives). Nonetheless, it remains a distinct possibility that strategic water point development will become an important part of the introduction of range management techniques when this is deemed socially, economically, and ecologically feasible. (It may also be noted that Klein, Keita, and Hamil (1981: vii) similarly conclude that range management changes do not make much sense without close articulation to water needs.)

E. SUMMARY

Project research is generating a great deal of detailed information about the distribution and use of water points as well as identifying areas where further water point development would be useful. In general, research has indicated that the zone's water supplies are relatively adequate for present pastoral adaptation; nonetheless, it may be possible to make them more adequate in terms of eliminating constraints in the production system, particularly those associated with the dry season. Various kinds of interventions are possible - surface water development in the north, the unlocking of pasturage through appropriately selected well construction (type, place), or improved technology for traditional wells. Their success depends on the herders themselves seeing utility in them. Eventually, water point development will form a critical component of range management schemes, possibly implemented by the higher levels of the cooperative structure. Above all, these interventions must be based on the kind of intimate knowledge of the zone which project research has begun to generate.

V. THE SUBSISTENCE ECONOMY

A. SUBSISTENCE OR NON-SUBSISTENCE

The primary goal of the NRL Project is to increase the income and well-being of the herders in the pastoral zone. Herders' incomes derive both from production for subsistence and from the marketing of surplus production; their well-being derives in a very large part from the degree to which their income is secure over time and is at least keeping pace with their needs. A major aim of development intervention in the zone is therefore to improve pastoral food production, food distribution, and food security; to provide secure employment in the pastoral economy; and to provide increased, equitably-distributed, less fluctuating and less risk-laden incomes to the pastoralists. Since income from marketing is of course highly dependent on the prior efficacy of the production enterprise, and that enterprise is geared above all to deliver the maximum contribution to domestic consumption, it is fair to say that the subsistence aspect of pastoralism in the zone is its central feature.

The purpose of this chapter is to examine that the NRL is learning about the subsistence economy and possibilities for its improvement. At the outset it must be understood that the term "subsistence" is being used in the narrower of its two senses. Nigerien pastoralists are not self-sufficient, and a significant proportion of the food they consume - let alone clothing, materials for housing, tools, etc. - comes from the marketplace. In the larger sense, then, the herders subsist from their own animal products, from animals and other food which they buy or barter for, and from wild foods that they gather. In turn, the cash that they use to buy food comes not only from animal sales but from paid labor as well. The NRL household economic surveys will provide accurate findings as to what constitutes subsistence in this larger sense and how it is gained. The year-round labor expenditure studies that are also under way will enable NRL analysts to ascertain possibilities for changes in many non-livestock activities that could contribute to overall household income. Labor-saving methods, skill development,

entry into new craft or labor markets, and changes in energy or storage technology are among areas that may appear as points of current or potential development.

To the narrower purposes of a livestock project like the URS, it is the domestic uses to which the animals themselves are put that define their role in subsistence. The contribution of livestock to subsistence in the pastoral zone is direct and crucial, and bears discussion in detail.

B. DIRECT SUBSISTENCE AS THE MOTOR OF THE PASTORAL SYSTEM

It should now be a commonplace that the Sahelian livestock enterprise is primarily a dairying operation. Ironically, because pastoralists contribute to the national economy as suppliers of animals for meat consumption, some early projects in the Sahel were modelled on beef operations that were largely irrelevant to pastoralists. To the contrary, the motor that drives the production system is the will to produce milk in sufficient quality and quantity to assure the highest possible levels of subsistence dairy consumption both in the short and long terms. As dairymen, herders in the project zone: (a) make herd movement decisions to assure the well-being of their milk animals, and monitor range conditions by watching milk production; (b) diversify the species mix in their herds in part to take advantages of the differing seasonality of milk production by different species; (c) make breeding and sales decisions based on outcomes for the milk supply; (d) use milk-producing animals as primary tokens of cooperation and sharing. Of course the herders are also realists, and know they cannot live on milk alone - that would take a herd of upwards 100 cattle to produce milk in the dry season for the minimum needs of a family of five adults (or their equivalent)!

1. Herd Movement and Milk Supplies.

Adequate lactation in milk animals requires good nutrition, with especially high levels of protein (for milk production, protein intake must rise half again as fast as total caloric intake), and trace minerals, good water supplies, and therefore good management.

Maliki (1981b: 40-42, ff.) shows how husbandry methods are geared to milk production. With luck and skillful management, in the rainy season WodaaBe can milk their cattle three times in a day. They know which water points favor or disfavor normal lactation. They relate the differing forage "capacities" of different plant species to the quality and quantity of milk production.

If there are not other reasons to move anyway, a decline in milk production noted in daily milking will signal to the herders that they should consider moving on to new pastures.

2. Species Mix and Milk Production.

For the WodaaBe (Maliki 1981b: 102), in general milk supplies 30 percent of dry season nutrition and more than 70 percent of wet season food (indeed, in good years some families will consume only milk for two months or more). A major element of herd construction strategy is to diversify in order to spread out, over as long a portion of the year as is possible, the flow of a supply of milk at least for family needs (Maliki 1981b: 107, 34, 18). WodaaBe hold that Bororo breed cows are better milkers than Azawak, and prefer the former despite the greater hardiness of the latter (though since the drought more Azawak have been brought into their herds). Camels not only graze a different niche in the ecosystem, but increase their milk supply in February just as cows are diminishing theirs. Goats probably give steadier supplies of milk than sheep, whose milk supply fluctuates more directly with the rains. In short, it makes ecological sense to diversify herds in the Sahel to take advantage of different aspects of the ecosystem (and the market economy), and the diversification also leads to subsistence production optimization.

3. Breeding and Sales Decisions.

The desire to increase milk supply also affects decisions concerning breeding and sales, that is, the ongoing structuring and restructuring of the herd. Maliki observes that in human kinship, descent through the male line is deemed important by the WodaaBe, but that their cattle are named for their dams (mothers) (1981b: 28). Nonetheless, in WodaaBe genetics it is the qualities of the bull that influence the milking capacity of its offspring (1981a: 106).

4. Milk and Sociability.

The ability to offer fresh milk to a visitor to one's camp is a simple but direct marker of minimal hospitality, and of course copious milk sharing is part of the deep joy of late rainy season ceremonials among both Tuareg and WodaaBe. Beyond this interpersonal level, guaranteeing a minimal subsistence supply of milk for every family is the essential concrete aspect of social security among the herders. Loans of milk animals to supply sustenance are the pervasive safety net provided for nearly all herders deprived of their animals in any way but by the most pervasive drought. Usually the animals themselves eventually return to their owners (sometimes one or two of the young may be given to help reconstitute the destitute man's herd), but always the gift of the milk supply is proof that even the chronically hapless will survive and that no one will die of hunger (Berns 1974: 66; Maliki 1981b: 101-102). The importance of assuring milk supplies throughout the society means that the relatively well-off have more animals in milk than they themselves can feed from, but that the "surplus" milkers will often be on loan. Since such loans also help secure political influence in pastoral communities, the strategy of building up one's milk herd has both economic and political motives.

5. Summary.

Maliki says of the WodaaBe (1981b: 28), and it might with nearly as much economic force be said of the Tuareg, that "the herding system gives priority to females: it all comes down to reproduction and milk production." Milk is the primary product of the herder, overwhelmingly for domestic consumption. And it is what makes the difference in health status for small children, pervasively protein-deprived in West Africa wherever milk supplies need to be purchased. For most of the pastoralists in the NRL zone, few milk products other than some cheese, butter, and occasionally some curdled milk, are marketed.

According to Dr. Loutan's research, the total quantity of cow's milk at the disposition of the WodaaBe family varied seasonally in 1980/81 from 2.5 liters per person per day during the rainy season in September, to 1.37 liters in November, .65 in February, and .37 in May near the end of the dry season. The net season figure is probably not high

enough to permit total caloric needs to come from the milk (Dahl and Hjort (1976: 154) give 831 kcal/liter as a maximum figure for pastoral cattle). Dr. Loutan's sample is a careful but small one, and the milk of other species is not included.

Given the centrality of milk to the pastoral production unit, planning for the improvement of herder incomes would seem to imply first a rasing of the milk production of Sahelian livestock. Cross-breeding programs with exotic milk animals, however, have been notably unsuccessful, in part because the other demands put on the livestock - for high temperature, high stress, and low water tolerance - tend to vitiate the potential gains. Line selection and breeding are more likely possibilities, but take time to develop, and the NRL has so far neither assessed previous work on the issue in other Sahelian situations nor attempted any work on its own. Veterinary and nutritional improvements may increase milk production: as on other issues, improved dry season protein supplies might offer a substantial lengthening of the period of high productivity per lactation.

On the other hand, it may be that these same improvements could increase the food security of the pastoralists not directly by increasing milk supply but indirectly by raising the number, quality, or pace of production of animals for market. However much pastoralists would like to extend their milk supplies, it will probably remain true that they will continue to see the logic by which they can now exchange surplus animals for two to three times the animals' <u>caloric</u> value in cereals. In short, the effects of increased security and/or quantity of milk supplies may show up in a <u>greater</u> subsistence role for milk; in increased redistribution of milk animals among herders, and/or in increased marketing of animals surplus to satisfaction of the family demand for milk. The NRL socio-economic research team may be able to analyze these effects with internal comparisons of livestock enterprises in their samples which are in different states of milk productivity relative to family needs.

C. PRODUCING MILK: THE LABOR FACTOR

Having established the centrality of milk production to the pastoral economy, we should here go on to discuss the factors involved in producing it. Land (and its associated resources like water) and the livestock captial itself are discussed in other chapters. Labor and its productivity are discussed in one dimension in the chapter on human health, but deserve a fuller account. Unfortunately, labor patterns are the least analyzed factor in pastoral production. Hence the studies now being undertaken by the NRL socio-economic team are not just crucial to understanding the details of central Niger, but are groundbreaking in the study of pastoral systems generally. They are based on the exacting measures elaborated (but not field-tested in a large sample, due to extenuating circumstances) by the NRL senior consultant in socio-economic work, Dr. Jeremy Swift (see Swift 1979: Chapters 5 and 6).

Data from the NRL sample households are now being processed, and will show the social division of labor; labor expenditures across the seasons for herd supervision, watering, and milking; patterns of herd management, labor availability and the efficiency of employment; cases of hired or shared labor; and the consequences of alternative employment on pastoral production. Internal comparisons should allow some discussion of cycles of family labor availability, economies of scale, and threshholds of underemployment or overexploitation.

All these measures are crucial to understanding what would happen if other elements of the production system, like herd health, range management methods, or access to water supplies, were to undergo substantial amelioration. While these studies will be completed by the end of 1985, it will be vital to institutionalize a permanent capacity for this kind of research to monitor ongoing changes, to undertake spot research on particular issues, and in general to tie range, veterinary, and marketing work to the pastoral producers themselves.

VI. PASTORAL COOPERATIVES

A. INTRODUCTION

The cooperativization of the pastoral zone in Niger is a key element both of government development policy and of the NRL project design. The stress on cooperativization has become more pronounced as planning has evolved over the past five years. Yet there were few prior attempts to build pastoral cooperatives, in stark contrast to the extensive cooperative structures among Niger's agriculturalists. Thus, the elaboration of an effective strategy for the cooperativization of the pastoral zone was itself an issue for research.

1. Traditional mechanisms of cooperation and mutual support.

Whatever new forms of cooperative effort might emerge, it was clear to the NRL that cooperatives do not get built in a vacuum. Existing social and economic systems are full of mechanisms of cooperation and mutual support, and any strategy for building new organizations would be lodged in ongoing social relationships.

> Traditional systems functioned to guarantee production, reduce risk, provide social security to the aged or ill or unlucky, and to organize physical security. One such mechanism of mutual support is the habba nae, the Fulani practice of loaning an animal to an often less fortunate relative or friend for a given period of time. For the herder who loans the animal, this is a risk-spreading venture; it reduces the chance that his entire herd will be affected by a disease outbreak or particularly harsh environmental conditions. In return, the friend or relative who takes care of the animal gets its dairy products and one or two of its offspring. Another example is the coming together and splitting apart of households to accumulate or disperse labor at certain times of the year. Both of these examples demonstrate how social mechanisms provide for the circulation of people and animals in relation to natural resources. A key example of this is rights to access to water, and thus to pasturage, which are non-exclusive and flexible; though the owner of a given well has the right to determine who uses that well and in what order, he seldom flatly refuses access to some one wanting to use the wells knowing that he too may someday need access to some one else's well. Thus, resource allocation too is conducted so as to ensure social, economic and physical security.

3. Questions raised by the drought.

Although these mechanisms of mutual support and cooperation were effective for most people most of the time, the drought of 1969-73 profoundly challenged their adequacy. On the one hand, the government discovered that its limited presence in the pastoral zone meant that it had few means of reading the severity of the distress or taking steps to relieve it, even though both it and the herders accepted that the government should provide material relief at such moments. On the other hand, it was also argued that the traditional mechanisms of cooperation were breaking down to such an extent that the government would have to step in to guarantee at least a minimum level of security.

> However, NRL researchers have observed that traditional loans like the haBBanae have been maintained and are frequent amongst herders. Individual families have been unable to rebuild their herds not because loan mechanisms have broken down but because there are insufficient numbers of animals at the group level to circulate between families. Herders with too few animals of their own for their subsistence needs often tend animals belonging to people outside the group, generally non-herders. The livestock owners do not let their stock partners keep these animals' offspring or provide other compensation for their herding work. Owners allow herders only to use their milk to subsist. Herders without animals of their own who are treated this way are not even paid labourers, and cannot begin to reconstitute their own herds. It is not clear how widespread this trend has become but it clearly implies that resources for herd reconstitution may have to come from outside the traditional system.

Cooperatives, then, are organizational vehicles for structuring new interaction between government and the pastoralists. While the extension of welfare and production-related services into the pastoral zone could be done without these organizational vehicles, cooperativization assures both a smooth flow of goods, information and services to known groups of pastoralists as consumers and a way of aggregating needs and articulating demands and information "upward" into the government system.

4. Implications of Cooperativization on Pastoral Social Organization.

The question arises, what impact will transforming traditional mechanisms of mutual support into vehicles of interaction with the government have on pastoral social organization? Basically, the impact would depend on both government strategy and the functions assigned to the group. This kind of social experimentation may

imply the application of new principles and new decision-making styles, and it may load old channels with new resources in such a way as to alter the nature of group interaction. NRL consultant James Thomson (1981 a,b) raises many questions about the potential social and political changes involved in the cooperativization of the pastoral zone.

> For example, how will the issue of authority be dealt with? Will it represent a formalization (possibly bringing about a change in the nature) of existing leadership? Or will new liaisons with government services and the creation of specialized personnel contribute to the emergence of new leaders? Will coop formation be a matter of identifying and recognizing existing 'groups' or will people organize themselves anew? How cohesive will the group be? Will presently very flexible ties become semi-permanent by constraints on entry and exit to the group? Will presently voluntary participation in mutual support mechanisms become more or less involuntary by virtue of membership in a coop? For example, how would community responsibility for credit arrangements affect group dynamics? Would it involve new pressures exerted by the group over the individual? How should the issue of payment for specialized functions be resolved? Is it correct to assume that people will be willing and able to voluntarily work for the cooperative in a specific capacity (e.g., as veterinary or human health sécouriste)?

These are some of the questions which always require careful evaluation, based on intimate knowledge of existing socioeconomic organization such as is being gained through the NRL's socioeconomic research team, before effective cooperativization efforts can proceed. Without the knowledge, what often ensues is the exacerbation of inequality, the incorporation of the cooperators into debilitating relations of dependency with external agencies, and the fresh subjection of the supposed beneficiaries to exploitative political processes.

B. SUGGESTED FORMS FOR COOPERATIVES

The process of cooperativization is one that is widely regarded as the means by which the development of the pastoral zone and indeed Niger in general is to be achieved. Beyond this consensus, however, there is a great deal of dialogue about what form the cooperatives should take. In this section, we will consider some of the forms suggested, as well as the more general category of changing

national policy on cooperativization, in order to put the NRL project's efforts into perspective.

1. "Pastoral Units"

The most elaborate organizational mechanism suggested to cooperativize the pastoral zone was the unité pastorale or pastoral unit, developed by the I.B.R.D.-sponsored Niger Centre-Est project on the basis of Chadian models. The project attempted to delimit pastoral units, defined as "an area of pasturage traditionally exploited in a regular way by groups as homogeneous as possible and for which, in general, it is considered that these groups possess use rights opposable to other groups" (IBRD 1978: 111). These pastoral units were devised as a method of meeting the project's three objectives: raising herder incomes by increasing livestock productivity and production, guaranteeing herder participation in development efforts, and augmenting the capacity of the livestock service (Government of Niger 1980a; 1). Pastoral units, then "....constitute a vehicle of intervention adapted to the pastoral context which will permit, among other things, easy response to herder's immediate needs and the effective introduction of the use of techniques to improve and modernize the pastoral milieu" (IBRD 1978: 13).

The definition of the pastoral unit (P.U.) means that " the delimitation of P.U.s will involve the attribution by the administration of exclusive rights to use pasturage and water" (IBRD 1978: 1). As such, the P.U. refers both to the parcel of land (and its resources - water and pasturage) and its exclusively associated pastoral group. The concept of 'exclusive use rights', however, is not synonymous with 'private property' or with totally exclusive use:

> ... the delimitation of P.U.s is in no way designed to partition off pastoral space: the geographic limits of the P.U.s are limits to service activities and not obstacles to the herders' mobility (IBRD 1978: 13).

For example, rainy season pasturage may be shared by several pastoral units; it is primarily dry season water points and pasturage that would be exclusively allocated in order to improve techniques of resource utilization.

Under the Centre-Est Project, the entire pastoral zone was to be divided into P.U.s, fundamentally based on traditional socioeconomic organization. Each P.U. would represent an area containing 10-15 wells, an ethnically homogeneous constituency of 1,500 to 2,500 people, and approximately 10,000 animals. These parameters for the delimitation of P.U.s were not to be rigid, but would vary according to the circumstance of each region.

At one point, the concept of P.U.s, as elaborated with IBRD assistance, had gained significant policy acceptance within the Nigerien government. For example, in December 1978, Dr. Ari Toubou Thanlia, currently Minister of Rural Development, then Director of the Livestock Service, spoke of the advantages of P.U.s as a strategy for developing the pastoral zone;

> The creation of pastoral units would allow better development of the range, increased herd productivity, and better living conditions for herders in terms of the supply of commodities, health and education, and as such would constitute the best method of solving the problems to be addressed by a new livestock development policy (Ari 1978: 2 - grammar of English translation in IBRD files is here slightly modified).

Dr. Ari goes on to note the usefulness of P.U.s in dealing with a wide variety of problems, from the diffusion of improved production techniques to the integration of nomadic and semi-nomadic groups into national life.

Following a period of initial enthusiasm and productive dialogue, it came to be realized that the task of organizing P.U.s was perhaps not the best way to <u>begin</u> the cooperativization of the pastoral zone. Indeed, the idea of organizing P.U.s has been postponed for the foreseeable future, as either an impossibly large task or so far beyond present knowledge of the pastoral zone that risk factors would be high. In particular, the allocation of exclusive use rights has been recognized as an extremely delicate task.

7. <u>Other Forms of Cooperatives</u>.

a. "<u>Cooperativization from Above</u>." The P.U. idea has been put into abeyance because the notion of assigning land rights was technically and socially premature. But similar forms of cooperatives, without the direction of pasture control, have also been discussed.

Early discussions within the NRL project and within the Nigerien government tended to envision herder cooperatives as relatively large-scale and as involving one or more of the following: multi-purpose, multi-ethnic, and/or as part of a multi-tiered organizational hierarchy, with links to the population extending downward.

Advantages. Cooperatives of this sort offer distinct advantages. As noted by Dr. Ari with respect to pastoral units, multi-purpose cooperatives can meet many of the pressing needs of pastoral communities and of government. They can act as the vehicles for the distribution of health and veterinary services; the organization of producer, consumer or marketing coops, the transmission of information about improved production techniques; or the allocation of credit. It was suggested by the NRL that coops could be multi-ethnic, in order to bring together groups - not otherwise formally associated - which already share resources, information and common problems (for instance, if they share a watershed and its pastures), and thus increase the level of interaction (and possibly cohesion) between these groups. Moreover, this strategy would reinforce the national policy of not building ethnic differences into organizational development. Above the level of the individual cooperative, establishing a multi-tiered organization for the pastoral zone (representative cooperative unions at the Arrondissement, Departmental and ultimately national levels) would facilitate interaction between herders themselves and between herders and the government. It would provide a direct link between the coops and the government services, and clearly define a network for the distribution of information services and commodities.

Problems. While it is clear that such organizations might present distinct advantages, they also pose some potentially serious problems. First and possibly most importantly, this sort of massive social engineering would require significantly different styles of interaction (both horizontally and vertically) and as such could present a profound challenge to or disruption of pre-existing social patterns. One issue frequently mentioned in this context is the nature of authority, which often changes or rigidifies when new levels of political organization are superimposed on pre-existing

patterns; the experiences of the Groupements Mutualistes Villageoise (GMV) in agricultural communities illustrate this tendency. Similarly, assigning different ethnic groups to the same coop may, under the wrong circumstances, only exacerbate existing tensions rather than build or further encourage the development of a common base of communication and interaction between groups. A second problem that could emerge is that in focusing on establishing vertical or hierarchical links within the pastoral zone, ultimately leading up to the government services (Human Health, Livestock, UNCC, etc.), there is a risk that the grassroots organization of herders would be neglected. The withering of the base units and an associated increase in the power of people who control higher organizational levels is a typical affliction of African cooperative movements. It is clear that over-emphasis on building up the top of a cooperative structure can be detrimental to the interests and participation of the community at large. All of this is not to say that such groups - large-scale, multi-purpose, multi-ethnic, and multi-tiered - are ultimately unfeasible for the pastoral zone; rather it is a matter of procedure.

b. "Cooperativization-from-below". Cooperativization from above can thus easily be too-much-too-soon. Mindful of these risks, NRL discussion of possible forms of coops shifted toward strategies that would proceed more cautiously, focusing first on the development of cohesion at the grassroots level. Efforts of this sort - cooperativization-from-below - would rely heavily on traditional mechanisms of interaction and confidence, building on pre-existing foundations rather than creating new styles of interaction. This form of coop is seen by its proponents as the only viable way to begin the distribution of resources to the pastoral population without significantly altering the social fabric of pastoral society in a way that might even impede development efforts. Negative consequences of change could be more easily controlled by using traditional mechanisms which guarantee equity and prevent the use of power by individuals in a way detrimental to the well-being of the group. Peer pressure or responsibility to the group is particularly important in this respect both to ensure responsible leadership, as a method of ensuring credit collection, and to make accountable such agents as the human health and veterinary recouristen. By rooting cooperatives firmly

in traditional principles of social interaction, it is felt possible to build accountability into the system, thus preventing undesirable aspects of social change. Once established, these local-level cooperatives could better support the effective introduction of more complex kinds of organization - multi-ethnic, multi-purpose, etc.

F. Nigerien strategies for cooperatives.

Nigerien government strategies for cooperativization in the country at large have taken two forms. The more recent, to be discussed first, derives from President Kountche's concept of the "Société de développement", or Development Society. The strategy of longer standing is the continuous work since 1962 of the Union Nigerienne de Crédit et de Coopération (UNCC) and related agencies. Since each of these two elements affects cooperativization efforts in the NRL, it is necessary here to review both and summarize the current status of NRL pilot activities.

a. The Development Society concept. In the late 1970s, the cooperativization effort in Niger received a new impetus with the introduction of the Development Society concept. By organizing the rural population into cooperatives, interaction with the government and its services can be articulated from below; this in effect sets up a structure to aggregate demand for government services, thus absorbing what might otherwise become disaffection and using it productively to enhance both the effectiveness of government services and the government's capacity to respond to perceived needs. Cooperativization, thus, is a central part of the nation-building effort and is manifestly not social development.

The "société de développement", President Kountché (as quoted in Thomson 1981a: 194) emphasizes, is the set of principles - not an ideology - to be put into practice by Nigeriens, and it is in the process of applying these principles that the development effort will take shape. By stressing the responsibilization of each citizen, President Kountché's implication is that every individual bears responsibility for determining the course of his or her own destiny; thus, the entire developmental process is characterized as one through which the Nigerien individual "should organize himself, forge and shape his own conception of life" (quoted in Thomson 1981 a: 194). This means that "... the actual organization of development rests on

the tripartite process of consultation, working together and participation" (quoted in Thomson 1981: 194). Popular participation in the national development process is given the utmost importance, since the Nigerien individual is both the means and the end of this process.

Implementation of Development Society. This popular participation is to be ensured through the "creation of a series of institutions, from the bottom up" which will be self-managed at each successive level (Thomson 1981: 194). (One might note that the principle of self-management not only guarantees popular participation in determining the course of development but also alleviates financial constraints and rationalizes the lack of manpower for development work in the countryside). These institutions, or 'development cells', are to take different forms, including Groupements Mutualistes Pastoraux (GMP). Such grassroots cooperatives are seen essentially as the building blocks with which the Development Society can be constructed.

With the Development Society theme providing a newly strengthened intellectual impetus for the cooperative movement, the Union Nigerienne de Credit et de Cooperation (UNCC), the government body charged with the responsibility for cooperativization, has set the end of 1981 as the deadline for the organization of the pastoral zone into cooperatives. Similarly, the Development Society principles form the base for the NRL's elaboration of a specific strategy for cooperativization in the Project zone. In the provisional internal regulations for pre-coopn, the NRL socioeconomic team suggests that:

> The institutionalizing of pastoral societies necessarily involves the winning of a minimum amount of autonomy, independence and the exercise of self-determination. The group is to be characterized by an effective sharing of decision-making power. It can identify its own problems, look for programmes of action, determine its objectives, structure its activities. This gives the associations a flexible organization, in accordance with differences between ethnic groups as with differences between socioeconomic subsectors (Socio-Economic Team 1981; 2).

b. Background of the U.N.C.C. Despite the ambitious plans for the past two years, until now not much cooperativization has taken place in the pastoral zone. The national cooperatives unit was created in 1980, with the initial responsibility of administering

predominantly agricultural credit. In 1967 the credit financial function was spun off to a seperate entity, the Caisse Nationale de Crédit Agricole (CNCA), but the UNCC has remained involved in the provision of credit through the cooperative system to farmers for the purchase of improved agricultural inputs. Moreover, the UNCC diversified its activities to include improvement of the marketing system (both of agricultural and consumer goods), the facilitation of collective investment and input distribution, and the provision of social services, like health care and education, through the cooperative system. The cooperative movement spread rapidly through the agricultural zone, with Groupements Mutualistes Villageois (GMVs) at the village level, 5-10 GMVs forming a cooperative, and 5-10 cooperatives forming a local cooperative association. This system began in 1966; by 1968, there were 177 cooperatives and 1,[illegible] GMVs. Growth slowed between 1969 and 1974, after which point it picked up again, due to a change in primary emphasis from cash crop to cereal production zones (USAID 1979: 60-61).

Thus, UNCC methods of organizing and interacting with the rural population were developed in the crop zone and are geared toward dealing with its particular problems. Nonetheless, charged with the new political impetus of the "Société de Développement", the UNCC has embarked on the cooperativization of the pastoral zone, and significant willingness to tackle the present problems has been shown on the part of UNCC officials.

c. Cooperativization in the pastoral zone. Two points about the cooperativization of the pastoral zone can be made here. First, there has been a general recognition of the special nature that cooperativization will have to take in the pastoral zone, given the specifics of pastoral society and economy. But so far, the fact remains that the problems of the pastoral zone are neither as well understood nor easily dealt with as those of the agricultural zone. For example, methods of credit collection in the pastoral zone will have to be significantly different from those used in agricultural communities. In the latter, credit repayment is based on a portion of the increase in crop production brought about through government assistance; in the former, it may prove difficult to find a pastoral equivalent to this process. Other areas which similarly require special attention include accountability, leadership and bookkeeping.

3. Implications of Cooperativization on Pastoral Social Organization.

The question arises, what impact will transforming traditional mechanisms of mutual support into vehicles of interaction with the government have on pastoral social organization? Basically, the impact would depend on both government strategy and the functions assigned to the group. This kind of social experimentation may imply the application of new principles and new decision-making styles, and it may load old channels with new resources in such a way as to alter the nature of group interaction. NRL consultant James Thomson (1981 a,b) raises many questions about the potential social and political changes involved in the cooperativization of the pastoral zone.

> For example, how will the issue of authority be dealt with? Will it represent a formalization (possibly bringing about a change in the nature) of existing leadership? Or will new liaisons with government services and the creation of specialized personnel contribute to the emergence of new leaders? Will coop formation be a matter of identifying and recognizing existing 'groups' or will people organize themselves anew? How cohesive will the group be? Will presently very flexible ties become semi-permanent by constraints on entry and exit to the group? Will presently voluntary participation in mutual support mechanisms become more or less involuntary by virtue of membership in a coop? For example, how would community responsibility for credit arrangements affect group dynamics? Would it involve new pressures exerted by the group over the individual? How should the issue of payment for specialized functions be resolved? Is it correct to assume that people will be willing and able to voluntarily work for the cooperative in a specific capacity (e.g., as veterinary or human health sécouriste)?

These are some of the questions which always require careful evaluation, based on intimate knowledge of existing socioeconomic organization such as is being gained through the NRL's socioeconomic research team, before effective cooperativization efforts can proceed. Without the knowledge, what often ensues is the exacerbation of inequality, the incorporation of the cooperators into debilitating relations of dependency with external agencies, and the fresh subjection of the supposed beneficiaries to exploitative political processes.

B. SUGGESTED FORMS FOR COOPERATIVES

The process of cooperativization is one that is widely regarded as the means by which the development of the pastoral zone and indeed Niger in general is to be achieved. Beyond this consensus, however, there is a great deal of dialogue about what form the cooperatives should take. In this section, we will consider some of the forms suggested, as well as the more general category of changing national policy on cooperativization, in order to put the NRL project's efforts into perspective.

1. "Pastoral Units"

The most elaborate organizational mechanism suggested to cooperativize the pastoral zone was the unité pastorale or pastoral unit, developed by the I.B.R.D.-sponsored Niger Centre-Est project on the basis of Chadian models. The project attempted to delimit pastoral units, defined as "an area of pasturage traditionally exploited in a regular way by groups as homogeneous as possible and for which, in general, it is considered that these groups possess use rights opposable to other groups" (IBRD 1978: 111). These pastoral units were devised as a method of meeting the project's three objectives: raising herder incomes by increasing livestock productivity and production, guaranteeing herder participation in development efforts, and augmenting the capacity of the livestock service (Government of Niger 1980a: 1). Pastoral units, then "... consititute a vehicle of intervention adapted to the pastoral context which will permit, among other things, easy response to herders' immediate needs and the effective introduction of the use of techniques to improve and modernize the pastoral milieu" (IBRD 1978: 13).

The definition of the pastoral unit (P.U.) means that "the delimitation of P.U.s will involve the attribution by the administration of exclusive rights to use pasturage and water" (IBRD 1978: 1). As such, the P.U. refers both to the parcel of land (and its resources -

of the N.A., and 6) diverse activities which the N.A. sees fit to undertake (well construction, establishment and maintenance of dry season pasturage reserves, etc.). The decision about which of the activities will be undertaken and how much of the revolving fund should be allocated is to be made by the entire group.

3. Pastoral Communities.

Eventually N.A.s will be incorporated into Pastoral Communities (PCs): 4 to 5 N.A.s from the same region will make up a P.C. (In government terminology, N.A.s and P.C.s correspond to GMPs and GVCs in the pastoral zone and GMPs and cooperatives in the agricultural zone). P.C.s can be multiethnic, though there must be at least two N.A.s from the group in the minority. In addition to the president of each constituent N.A., a local administrative authority, a delegate from the MRCC and one from the MRL would be permanent members of the P.C. Initially, the P.C.'s purposes would be three: 1) to oversee the N.A.s, 2) to create liaisons between N.A.s, and 3) to facilitate exchange between local administrative and technical services and the N.A.s. In other words, the P.C.s would start as vehicles of interaction without any real functions. After the P.C.s pass through their experimental stage, however, they will be responsible for important undertakings, including the introduction of an improved range management system. Furthermore, the P.C.s will eventually be incorporated into one large Pastoral Center (of which there is presently no agricultural equivalent) which will bring P.C.s into contact with each other and with cooperatives in the agricultural zone. Thus, cooperativization is to move forward from the bottom up, with the emphasis on establishing [illegible] at each level before proceeding to the next, until a 'pyramidical' structure is in place.

4. MRCC/MRL collaboration.

In terms of the N.A.s and P.C.s, the nature of the relation between the MRCC and the MRL has yet to be precisely defined, though it will clearly be one of collaboration. Meetings with MRCC representatives in Dahous and Tehintaharaden (Swift 1981b) gave rise to several suggested areas for cooperation between the MRCC and the MRL, specifically the provision of credit and the

supply of basic commodities. With respect to the former, the UNCC representative at Tahoua suggested that the NRL help the UNCC provide a revolving credit fund for herd reconstitution and consumption loans during the dry season. With respect to the latter, it was proposed that the UNCC and NRL work together to identify areas where herders are particularly in need of basic commodities (millet, tea, sugar, Bilma salt, and other goods) at reasonable prices. The NRL could assist not only financially but logistically in terms of locating sources of supply, especially for millet, and providing transportation.

D. DEVELOPMENT WITHOUT COOPERATIVES?

In spite of the fact that cooperatives are generally accepted as the best method of addressing herder needs, it is important to ask the question, what if there were no cooperatives? Two opposing views exist on this subject. On one hand, there are those who maintain that services necessary for the development of the pastoral zone could be adequately and in fact would be better provided without building a framework of cooperatives as recipients for those services. They argue that efforts at social engineering are unnecessary, often heavy-handed, and even potentially detrimental to the realization of development goals. On the other hand, there are those who assert the need to structure demand for government services through institutional development in order to prevent a "first-come-first-served" system from catering to those consumers with the money or influence to obtain the lion's share of those new resources.

Although both views express important points, it is clear that equity considerations are difficult to build into development efforts without the existence of an equilibrating framework through which new resources can be channelled. The herd reconstitution programme which followed the 1973 drought provides an example of the provision of services outside of an institutional context. In the urgency of the post-drought situation and in the absence of pre-existing channels of distribution, the government made animals available to herders in a necessarily ad hoc way, in an effort to encourage the rapid restoration of herd sizes and livestock production levels to their pre-drought levels. This meant that it was difficult to ensure that

government-provided animals went to those who needed them most rather than those who were able to gain access to this assistance through, for example, exercise of power and influence. This suggests that where demand for services radically exceeds supply, as is often the case in the pastoral zone, unless demand is structured, there is a danger that services will be distributed on an unequal basis. This principle similarly applies to the kinds of syndicates formed for particular purposes (marketing or well-construction, for example) suggested by some NRL team members: again those who could best afford such services might get together and monopolize them while those who cannot afford them would have to do without. Problems of this sort are not automatically avoided through cooperativization, but they are less likely to occur.

E. SUMMARY

Cooperativization forms the cornerstone of the UNCC and NRL's strategy for the development of the pastoral zone as well as acting as the vehicle whereby President Kountché's Development Society principles can be applied. After a considerable amount of productive dialogue - within and between the NRL, UNCC and the pastoral population itself - about what form the cooperative effort in the pastoral zone should take, guidelines for this effort have now been established. These guidelines, while allowing for a necessary degree of experimentation in initial cooperative undertakings, put central emphasis on the development of a strong organisational base at a grass-roots level from which cooperativization can proceed. Following these guidelines, the NRL has outlined a strategy to create multi-purpose Herder Associations and is now, in 1982, creating the first several such associations. It is clear that (even while UNCC efforts proceed to cooperativize much of the zone at a rapid rate) the pre-cooperatives sponsored by the NRL will need a year or two of full operation before adequate assessment can be made as to how viable an instrument they are for the achievement of both pastoralists' and government's aims.

VII. HUMAN HEALTH

A. INTRODUCTION

The pastoral economy requires healthy people as well as it requires healthy animals. Human labor is a vital factor in the pastoral production system, and its productivity is subject to the influence of a wide variety of factors - environmental, nutritional, epidemiological. Thus any effort to improve pastoral production must necessarily include an examination of human health and an attempt to address the problems revealed through research. Simultaneously, it is important to recognize than, apart from the production-related aspects of human health, the goal of raising the herders' quality of life gives improving human health value in itself.

Reasons for NRL Human Health Research.

Although not originally included in the project design, the NRL has undertaken research on pastoral human health conditions for three reasons. First, as the government begins to work in the pastoral zone, planners from sedentary population must confront the stereotypes that exist about pastoralists. These images are themselves contradictory. On the one hand, pastoralists are viewed as different from other people because of the way in which they live. On the other hand, there is a kind of admiration of pastoralists' seemingly remarkable ability to live under very harsh conditions. One task of human health research, then is the demystification of the 'other-ness'of pastoralists by demonstrating that herders do have health problems and are eager and able to learn improved methods of dealing with them.

Second, the health problems faced by pastoralists are different in nature from those faced by agriculturalists. For example, in the pastoral zone, the 'hungry season' (soudure) occurs three months earlier than it does in the sedentary zone; this means that herders are under stress at a different time than farmers, and seasonal fluctuations in disease patterns follow different patterns. However, to adapt the national health care program to the particular needs of pastoral populations, extensive research in the field is necessary to develop an adequate picture of human health and nutrition in the pastoral zone.

At present, the situation is not well-understood, partially because disease patterns as reported to authorities often differ significantly from those actually found in the bush. This is a result of the fact that nomadic people are less likely than their sedentary counterparts to visit dispensaries when a health problem occurs for at least three reasons: 1) Nomadic camps are likely to be far from dispensaries, sometimes up to 50 km (Loutan 1982: 112), and the distances often make a trip for health care reasons impossible given work schedules, so the trip may cost too much in time lost and in cash. 2) Even when a herder has decided to undertake travel to the dispensary, he is still less likely to make a special trip for this purpose alone; rather, he will attempt to combine several purposes for taking a trip to town, for example by going on a market day when he will sell an animal, buy some grain and drop by the dispensary.

> This phenomenon is confirmed by the findings of a study conducted by the dispensaries at TchinTabaraden and Abalak: on ordinary days, 12% of those visiting the dispensaries for the first time and coming from outside the town, were Tuareg or Fulani herders, compared with 49% on market days or the day after the market (Loutan 1982)

3) If there is knowledge that treatment for a particular problem will require more than one visit, herders are sometimes reluctant to go for treatment at all, since they cannot make the follow-up visit. The need for repeated visits to the dispensary presents other problems as well, to which we will return below. All of this amounts to the fact that the understanding of disease patterns as might be gained through the dispensary statistics does not accurately reflect the actual incidence of disease in pastoral communities.

The third reason for project involvement in human health issues in the pastoral zone is related to the logistics of the delivery of health care services. Pastoral populations are highly mobile, widely dispersed, often far from dispensaries, and difficult to reach, even by highly organized vaccination campaigns. This situation presents numerous constraints on the delivery of regular health care services, and it further stretches resources which are limited even for the easier to reach sedentary communities. These constraints have meant that the needs of nomads - poorly understood in any case -

have not been addressed, nor has the existing Niger system of secourism had a really significant impact on herder health.

B. SUMMARY OF RESEARCH FINDINGS

The human health research undertaken by the project under contracts with Dr. Louis Loutan provides information on a wide variety of subjects and begins to create a picture of health and nutrition problems in the pastoral zone. It is necessary, of course, to take into consideration the fact that many of the findings are at this point preliminary. Nonetheless, the research conducted thus far has begun to distinguish the patterns of health and illness in the pastoral population, the major points of which are summarized below, in three sections: 1) existing health practices, 2) general health conditions, and 3) disease patterns.

1. Existing Health Practices.

Far from being the exclusive property of Western medical science, identification and treatment of illnesses is also of course an integral part of traditional WodaaBe and Tuareg culture. Research undertaken in both pastoral groups indicates that traditional medical practices are well-elaborated. In some cases, long-practiced methods of treating given diseases correspond closely to 'modern' medical techniques. For example, among both the Tuareg and the WodaaBe (as well as in other African societies), a rudimentary form of vaccination against smallpox is practised on a wide scale: Loutan (1983: IV) found that 80% of WodaaBe herders over 20 years of age had vaccination marks on their sholders and upper arms, and in 80% of these cases the scars came from traditional smallpox vaccinations.

Traditional Tuareg Meidcal Practice.

In Tuareg society, two levels of treatment exist. The first is directed toward a wide range of diseases, from stomach ache to syphilis. Treatment is done within the nomadic camp by a non-specialist who will confine the sick person to his or her bed, give the individual specially prepared food or drink, and sometimes administer particular compounds to the symptoms of the disease

(e.g. red clay and water for measles, hot goat fat for syphilis pocks, etc.). The second category of treatment is directed toward severe cases of illness of diseases which are seen to be spiritual in orgin, such as epilepsy. In this case, two options are open. First, the sick person's relatives will organize a tende or an amzad, both forms of exorcism. If this fails, a marabout, or spiritual/religious healer, may be called in. (This option is often a last resort since it is expensive and recovery is not guaranteed.) Religious healers, often themselves herders, gain reputations for treating particular problems; thus, while some specialize in curing spiritual disorders, others sell charms or mixtures to prevent or cure one or another disease or health condition (e.g., talismen that make sterile women fertile) (Bernus n.d.).

Interaction of Traditional and 'Modern' Medical Practices.

This brief survey of existing health practices raises an important issue: in what way does the extension of 'modern' health services into the zone interact with traditional medical practices? In general, there is a strong demand for 'modern' health care services, though thus far the logistics of delivery have prevented such services from becoming widely accessible. Nonetheless, it should be recognized that the existence of traditional medical practices and above all practitioners in the pastoral zone presents both areas of potential conflict and areas of opportunity for project efforts. The provisional statutes for pastoral associations (Socio-Economic Team, 1981) recommend that technical counsellors, including the one for human health, be selected from those traditionally specialized in particular areas where this is possible. Thus, traditional medical practitioners could form the basis of the human health auxiliary (secouriste) program, at least in some cases. However, there is also the possibility that the secouriste system may compete with existing medical practice, and as such may be resented by traditional practitioners. They may be unwilling to become secouristes if this involves doing for free what was previously done for profit. (Indeed, such unwillingness has been reported by several observers.) Certainly it is apparent that the effectiveness of 'modern' health service delivery would be enhanced if the traditional services are taken into consideration in formulating programs.

Absence of Midwives in Pastoral Societies.

A specific problem in this respect is the absence of specialist midwives (matrones) in pastoral societies. In sedentary communities, government health service efforts to improve maternal health, child-birth methods and neo-natal care are facilitated by the existence of specialists in these areas. Information about improved techniques can be channelled through these midwives who will in turn modify their practices and pass information along to the women with whom they come into contact. Dr. Loutan (1980:4) suggests that the high mobility and level of dispersion of pastoral populations prevent such specialists from emerging: each woman must know what to do during pregnancy and childbirth and accommodate her own needs. Among the WodaaBe, this knowledge is transferred by a woman's mother, with whom she goes to live for one year from the fifth month of her first pregnancy. After that she gives birth alone or with the help of another woman in her camp. Since this information and support network is significantly different from the one that exists in sedentary communities, Loutan (1980: 5) suggests that, rather than creating midwives in the pastoral zone, it would be preferable to hold educational meetings among women in pastoral camps to teach improvements in traditional techniques. This would have the advantage of reaching a greater number of women and diffusing the improved techniques on a larger scale. Simply insisting that pastoral society should have midwives because sedentary society does will not help much.

2. General Health Conditions.

Research conducted thus far has indicated that general health conditions in the pastoral zone are relatively good, although several areas where improvements could be made have been identified. Here we will discuss Loutan's (1980) findings on four central issues: a.) background material on nutritional patterns, b.) adult weight loss and stress patterns, c.) child malnutrition, and d.) public hygiene.

a. Background Material on Nutritional Patterns. Although subject to variation across the year, the pastoral diet is basically

balanced, with access to animal protein through milk assured for a good part of the year. Put simply, the pastoral food base oscillates between two poles: milk and cereals (Loutan 1982: 26). Although it is difficult to characterize the pattern with any precision due to the scarcity of data on milk production and cereal consumption, the general trend is clear. The quantity of milk available for human consumption is highest during the rains, when average daily consumption is estimated at 2.5 liters (Loutan 1982: 51). By November, this figure is reduced by one-half, though the quality of milk is better than during the previous season. Milk production continues to decline as the dry season advances, hitting the bottom of the cycle in May when some families consume no milk at all.

As milk production declines, cereal consumption increases, although cereals do not always fill the gap in caloric and nutritional needs left by declining milk production. Loutan has suggested that there is a strong relation between socio-economic factors and the extent to which this 'gap' is filled, that is, the family's ability to purchase grain determines whether or not food needs will be met adequately during the time of year when milk production declines. In any event, the complementarity of milk and cereal is demonstrated in Loutan's (1982: 47-54) study of food consumption patterns. From February to May, cereal consumption increases, peaking in the latter month, then declining until November.

b. Adult Weight Loss and Stress Patterns. Weight loss in adults indicates an imbalance between energy needs and actual intake. The 'hungry season' (soudure) represents a critical period: from February to May, weights drop an average of 3.1 kg for men and 2.4 kg for women (Loutan 1982: 70). Loutan (1982: 70) identifies this sudden weight loss as part of a general condition of stress which results from the interaction of several factors. First, energy needs increase because this phase in the transhumant cycle demands great physical activity to overcome increasingly difficult environmental constraints (long distances between water sources and pasturage, frequent displacements, strenuous labor to draw water

from the wells in intense heat, etc.). Second, available caloric and nutritional intake declines as milk supplies dwindle or disappear, and cereal prices are on the rise. Thus, the activity level increases while energy intake does not cover these increased needs, resulting in weight loss. This relates back to our discussion of seasonal 'gaps' in nutritional needs. A proposed methods of counteracting the negative effects of the hungry season will be discussed below.

c. Child Malnutrition. The research also begins to provide an understanding of child malnutrition in the pastoral zone, although the results are not conclusive, partially as a result of the small size of the sample (29 WodaaBe children). There is a widely held opinion that herders do not suffer from malnutrition due to their access to animal protein through milk. In contrast to this view, Loutan's (1982: VI) studies reveal that about 12% of WodaaBe children under five suffer from acute malnutrition.

> Beyond this, however, it is difficult to make precise statements about the nature and extent of the problem. Two points can be mentioned here. First, the incidence of acute undernourishment (recent nutritional deficiency) is subject to seasonal variation. The rate of acute undernourishment increases as the dry season proceeds - milk supplies diminish or disappear, transhumant movements become more strenuous, other health problems increase in frequency, and the pastoral enterprise enters a period of general stress - and decreases again when the rains begin. Yet the extent to which this acute malnutrition is only temporary is not clear; it appears that it represents a critical period during which a child risks falling into the 'chronic malnutrition' (prolonged nutritional deficiency leading to subnormal growth) category. The rate of acute undernourishment varies between 3% and 17% during the course of the year, peaking in May and reaching its lowest point in November.
>
> Second, it is difficult to explain the incidence of chronic malnutrition as it is not characterized by significant seasonal fluctuations nor can movement in and out of this category be easily accounted for. The proportion of children whose growth in height appears to be stunted (an indication of chronic malnutrition) remained just below one-third of the sample throughout the year. Loutan (1982: VI) points out that this kind of malnutrition is a reflection of the availability of food across several years and suggests that two factors are operative: 1.) in the aftermath of the drought, herd size may still be below the level necessary to support family nutritional needs, leading to temporarily pronounced problems, and 2.) the family's economic situation is probably linked to their ability to assure adequate nutritional intake (to purchase enough grain to supplement diets

when milk production is low, to maintain a herd size and composition which will maximize available nutritional intake, etc.)

In short, while the factors affecting the incidence of malnutrition in the pastoral zone remain to be more precisely defined, it is clear that a nutritional problem exists on a larger scale than has previously been assumed.

d. Hygiene. Research on public health issues in the zone provides a great deal of empirical data from which three central themes are generated. First, public health problems in the pastoral zone differ significantly from those found in sedentary communities. In the latter, problems often stem from standing water or fecal contamination in and around immobile communities, while there is a supply of water year-round even if it is not always adequate. Among pastoralists, there is likely to be less standing water and movement away from polluted sites, but the supply of water fluctuates substantially across the year. For this reason, preventative public health programs in the pastoral zone cannot simply be adapted from those launched in sedentary communities; rather, they must be designed specifically to address herder needs. Second, there are times of the year when their ability to overcome hygiene problems is limited. An important case of this is that, despite concern with personal cleanliness, water is scarce at certain times of the year. Little water is available at the camps, and people can wash only at wells. Consequently, hygiene conditions at the camp deteriorate. This coincides with a period during which the incidence of skin disease is high. Third, by studying the way in which both humans and animals share the microbial community - communal eating, drinking, and bathing; food preparation practices; camp movements and herd watering techniques, etc. - we are better equipped to deal with the channels for the transmission of disease rather than simply treating the symptoms.

2. Disease Patterns.

In order of importance, the most frequently reported illnesses among adults are 'fever', 'cough', osteoarticular pains and diarrhea, skin diseases and sores. Toutan (1982: IV) shows that the incidence

of these diseases fluctuates with the rhythm of the seasons and the transhumant cycle. "Fever" is most common during and after the rainy season, cough and skin diseases reach their peaks in February during the cold season, and diarrhea is most frequently reported during the hot season. Osteoarticular pains are present year round but are most widespread in May and in August (during the height of the rains); this is a major cause of bedriddenness. The cold season is a particularly hard time of year; in February, 45% of those over 12 years old in Loutan's sample were bed-ridden as a result of illness, 64% of these due to cough (Loutan 1982: IV).

Disease patterns among children correspond closely to those found among adults. Again, "fever" is most common during the rainy season, representing one-half of all reported child illnesses in August. The incidence of cough is highest in February (60% of child illnesses), but is present year-round. Whooping cough is occasionally epidemic in the pastoral zone. In the hot season, diarrhea represents 40% of all child illnesses, compared with under 20% in adults; Loutan (1982: VI) suggests that this may be related to the observed increase in acute undernourishment in children during this period. It is also interesting to note that the incidence of diarrhea in nomadic children may have some connection with the reduced availability of water during the hungry season. Skin diseases are most wide-spread during the cold season. In general, as with adults, the cold season seems to be the worst time of year for child health; only 8% of children under five years of age were <u>not</u> sick, compared with 32% in September (Loutan 1982: IV).

Other important diseases in the zone include the following:

- <u>Malaria</u>. This is a problem during the first displacements of the rainy season, causing some bedriddenness at a time when labor needs are high. Since the mosquitoes disappear within a few days after the pasturage dries a highly strategic and effective intervention would be to give herders access to chloroquine, via the recouvreiter, at this moment.

- <u>Measles</u>. This disease is relatively rare in the zone (only 15% of children under 10 have had them). The distances between nomadic camps may help minimize the risk of epidemic.

- Tuberculosis. The acutal incidence of tuberculosis appears to be higher in the pastoral zone than was previously assumed, though it is difficult to estimate precisely. Milk may be the major source of contamination. The annual vaccination campaign has not been particularly successful due to the logistics of reaching the nomadic population; limits of finances, personnel, and equipment available for the campaign often mean that only people near the roads are vaccinated (Loutan 1982: IV).

- Brucellosis. Like tuberculosis, brucellosis seems to be more of a problem than was originally thought - though little more can be said than it exists, and its incidence is not negligible. Brucellosis affects those in close contact with animals, from whom the disease is caught; thus, along with several other diseases mentioned here, it is a disease to which nomads are particularly exposed in contrast to their agricultural counterparts. Presently, no treatment for brucellosis is available at the dispensaries and anyway the month-long treatment with tetracycline would make treatment very difficult. Nonetheless, Loutan (1982: IV) recommends that the Health and Livestock Services plan to launch a concerted effort to eradicate brucellosis, following an evaluation of its incidence in the pastoral zone.

- Vitamin A Deficiency. Lack of vitamin A causes night blindness in both animals and people. This occurs most frequently during the hot season when milk supplies - the principal source of vitamins for herders - are low and moreover are of low quality. Nightblindness hits pregnant and breastfeeding women particularly hard. This illness is an example (and shows the need for systematic study) of the close relationship between the environment, animals, and people. With the steady disappearance of green pastures from September to March, animals' intake of provitamin A decreases, leading to weaker concentrations of vitamin A in their milk and thus vitamin deficiency in herders.

- Venereal Diseases. Again it is difficult to estimate the scale of this problem in the pastoral zone. On one hand, the dispensaries report a high incidence of veneral disease among nomads and identify it as one of the major problems faced by herders. However, Loutan suggests (1982: IV) that dispensary records may overrepresent the incidence of veneral disease; since herders are unlikely to visit the dispensaries except for the most troublesome

diseases (of which venereal disease is one) and when it is convenient, the incidence of gonorrhea and syphillis as reported by the dispensaries may be too high both in general and as a proportion of total illness. On the other hand, the field research necessary to establish the actual incidence of venereal diseases is difficult to conduct, partially due to the social necessity of a high level of discretion.

The case of venereal disease does point to a major shortcoming of the dispensary system for meeting herder's health needs: since herders cannot make frequent trips to the dispensary (for reasons discussed above), it is difficult to follow through with treatments that require repeated visits. Such is the case with the penicillin infections necessary to cure gonorrhea and syphillis; usually the symptoms disappear after the first injection, and often the herder does not return to the dispensary to complete the treatment. When treated partially, the disease may become chronic. One method of preventing this from occurring would be to introduce a high-dosage single treatment for those who reside too far from the dispensary to return for subsequent injections.

D. CONCLUSIONS AND IMPLICATIONS

Three points should be emphasized from the above discussion. First, in general, the human population in the pastoral zone appears to be relatively healthy - nutritional problems are not acute, nor are the nature and extent of disease patterns particularly alarming. Nonetheless, certain problems do exist, and are beginning to be identified with greater precision. Second, studies indicate that the level of labor loss due to health problems is especially high during two periods: 1) the cold season, when the incidence of bed-riddenness is highest, and 2) the dry season, when environmental stress is hardest. The hungry season of March to May is characterized by general stress and pronounced weight loss, and it is the critical period to which health and nutritional interventions must address themselves. Third, the research has revealed that the human health situation of the pastoral zone is significantly different from that of sedentary communities as a result of factors

linked to their respective environments and adaptations. As a major example, the hungry season for pastoralists is several months earlier than it is for agriculturalists. For this reason, interventions in the pastoral zone must be specifically directed toward the timely addressing of herder needs which the project has begun to identify.

D. SECOURISTE PROGRAM

The information gained through NRL research provides an important contribution to the development of appropriate strategies of improving human health conditions in the pastoral zone, one major aspect of which is the secouriste program. Research results provide informational inputs for the development not only of the substance of an effective secouriste program but for the logistics as well, in terms of supplying information about migration patterns, population densities and outreach needs.

Armed with its growing understanding of health and nutritional conditions in the zone and with its credibility among herders, the NRL in 1981 stimulated one round of training of human health auxiliaries from pastoral camps:

> At the end of February, 1981, nine herder secouristes were trained at Tchin Tabaraden. The group consisted of three Tuareg sized farmers, three Tuareg herders and three WodaaBe herders. Only one of the secouristes had been to school; he could write in French, Tifinar and Arabic. Three other Tuareg wrote Tifinar, and the remaining five could neither read nor write (this presented problems for recording and evaluating their experience). During the dry season, they covered the area around Tchin Tabaraden and Kao. During the rainy season, the three WodaaBe secouristes stayed within a 60km radius of Tchin Tabaraden while the three Tuareg herders moved north of Tchin Tabaraden. The secouristes were connected with the dispensaries in Tchin Tabaraden, In-Gall and Kao. At the end of March and again in the middle of June, the supervisor of the pilot intervention, Dr. Loutan and the Tchin Tabaraden dispensary nurse, toured around the area to monitor the secouristes' activities. Loutan (1981c: 1) emphasizes the high expenditure of time, money and energy required to conduct these visits (for the first trip, approximately 25 hours spent in the field, 760 km covered, 90 liters of gas used; for the second, 22 hours, 520km, and 130 liters of gas). He notes that, while such supervision is necessary from time to time, its high costs make it an unacceptable general model. Supervision of secouristes must be regular and frequent (and low-cost); in

this light, one possibility is to increase the level of interaction between the secouriste and the dispensary, which the secouriste would visit when he goes to the market.

Although it is early to pass judgment on the effectiveness of this pilot intervention, partially due to its newness and to the fact that written records of activities are not entirely reliable, the preliminary results are encouraging. Moreover, the program has stimulated productive discussion about what form of secourism is most appropriate for the pastoral zone. The dispensary nurse who trained the secouristes at Tchin Tabaraden was a central and enthusiastic participant in Ministry of Health seminars on "autocencadrement" in the pastoral zone in June of 1984. The results also demonstrated to government services the herder's willingness and ability to learn and their receptivity to this type of service. Finally, the secouriste program enhanced the project's image in the zone. It simultaneously (and inexpensively) gained herder confidence while filling a strong need for this type of service. By implementing a low-cost delivery system, national practice was reinforced and a response was given to the demand of the pastoral community for access to improved health care.

VIII. MARKETING

A. THE IMPORTANCE OF MARKETING TO PASTORALISTS

1. Market Orientation of Pastoral Production.

The literature on pastoral economies expresses recurrent doubt as to whether pastoral production can be called 'market-oriented', or at least whether it is market-oriented in the same way as other kinds of production. The Center for Research on Economic Development (CRED) study on livestock and meat marketing in West Africa (1980: 15) points out that discussion usually concerns whether or not pastoralists 'dispose' of their marketable animals in a manner consistent with sound economic behavior. It is often assumed that since in pastoral economy and society animals are important for many reasons - not just economic - herder attitudes toward selling their animals will be colored by a variety of 'emotions', and not just by profit motivation. Of course, if herders are unwilling for sentimental reasons to part with their animals, they put additional pressure on scarce Sahelian pasture resources, and render efforts to increase production levels useless since they will not lead to increased levels of offtake (CRED 1980: 15). Or it is said that animals are marketed in an economically irrational way, signalling that herders are insensitive to normal market indicators, namely price fluctuations, since market considerations are not of high priority in their herding strategy.

However, an examination of the research on the role of marketing within the pastoral system demonstrates clearly that marketing is an integral activity, not merely an afterthought. The production of animals for profit is certainly not the only production decision; indeed, social, political and subsistence considerations also play important roles. However, on closer examination the complexity and the market rationality become apparent.

2. Indications of Market Involvement.

Let us present some of the data which illustrates the importance of marketing within the interrelationships with other aspects

of the pastoral production system.

a. Volume of Trade. The World Bank (1979: 2) estimates that while livestock production accounted for 12% of Niger's GDP in the late 1970's, it provided 20% of the total value of exports. At present levels, these statistics alone demonstrate the high level of livestock marketing and the need to address development concern to the sub-sector.

b. Dependence on Market for Satisfaction of Basic Needs. Possibly the most striking point about the role of marketing in pastoral production is that herders' basic needs are not and probably never were fully met by pastoral production. Although animals provide herders with a good deal of their subsistence requirements at certain times of the year, seasonal variations in milk production make it necessary for herders to procure food and other essential commodities from outside the pastoral economy. Bell and Hjort (1976) demonstrate that it is virtually impossible for nomadic families to subsist, throughout the entire year, on their herds. Attempting to estimate the minimum cattle herd size (assuming typical age and sex composition) necessary to support a nomadic family of six entirely from the produce of their herd, Bell and Hjort calculate that 73 animals would be necessary during the rainy season, but in the dry season, when only 4% of the total yield is lactating and individual yields are low, the required size to meet family requirements would be 593 animals! As such herd sizes are clearly impossible (at least under present circumstances), it is not surprising to find that, in Cutter's study of 33 WodaaBe families, 31 families reported that they were buying millet all year long (Cutter 1979: 59). Moreover, evidence seems to indicate a change over time toward greater reliance on the market for procurement of basic subsistence needs, though the extent of [illegible] changes are difficult to assess. This issue will be [illegible] extensively below; the point here is that the commercial role of livestock is hardly a secondary byproduct of pastoral production; rather, reliance on commodities outside their production system for the fulfillment of basic requirements necessitates regular and close interaction with the market.

c. Relation between Marketing Patterns and the Transhumant Cycle. The pattern of marketing in the pastoral zone is inextricably linked to the transhumant cycle. Sutter (1978: 13) identifies five inter-related factors which explain a herder's decision to sell a particular animal in a given one-year period:

1. Need for Cash. The transhumant cycle is such that a herder's need for cash varies across the course of the year: the greater the need for cash, the greater the likelihood that an animal will be sold. In some cases, such as millet purchase during the dry season, the need for cash is immediate; in other cases, like replacement of an old piece of equipment, the purchase can be delayed and the need for cash is less acute.
2. Transhumant Movement and Seasonal Variation in Herd Condition. Variable factors in the transhumant cycle present incentives and disincentives to sell at various times of the year. Levels of milk production and the inversely-related need for millet, distance from markets, cycles of animal weight gain and loss all play roles in herder marketing strategies.
3. Prices. Seasonal variation in rainfall produces sharp variations in animal weight and a marked seasonal variation in commercial offtake rates; this in turn creates price fluctuations which present both advantages and disadvantages to a herder wanting to sell an animal.
4. Herd Composition. The greater the species diversification of a given herd, the greater the herder's ability to time his animal sales to coincide with favorable price trends for each species and the greater his ability to sell according to his cash needs at a given time.
5. Health Conditions of Animals. A herder may be forced to sell an animal at any time during the year if it falls sick or becomes particularly weak; the price for such an animal can be as low as 20% of its value if healthy.

The influence of these factors results in general patterns for the timing of cattle and small ruminant sales which Sutter (1978: 14-17)

summarizes as follows:

Cattle sales can be divided into three periods:

1. The period of least market activity for cattle begins shortly after the rains, hitting bottom in July or early August. This is the time when herders are far from markets in their northern pastures. Herders refrain from selling during this period anyway, since milk production is high and animals are gaining weight.
2. Cattle sales rise slightly from September to November; milk production is declining, thereby increasing the need for purchasing grain and thus to commercialize animals.
3. The period of peak cattle sales begins in December of January and lasts until the beginning of the rainy season. At this point, milk supplies are negligible, especially in April and May, and millet prices are rising; the need for cash is increasingly acute for herders in general so more cattle are entering the market, exerting a downward influence on cattle prices at a time when millet prices are rising, putting herders at an obvious disadvantage. Furthermore, dry season stress causes weight loss and poor animal health, exerting further negative influence on cattle prices.

Sheep and goat sales occur throughout the year, particularly to cover small frequent expenses. Nonetheless, two peak periods of commercialization can be discerned:

1. The lesser of the two occurs during the rainy season when herders are reluctant to sell their cattle for reasons given above. Small ruminants, then, are sold to buy millet and other basic commodities, and to provide an entertainment budget important for the socially active time of the salt cure (Sutter 1978: 17).
2. The greater peak period occurs from October to January after the millet harvest, when peasant demand for meat and animals is highest. Also the condition of goats and sheep deteriorates after January, so herders prefer to sell while prices are high and animal condition is good.

Thus the marketing patterns in conditioned by the transhumant cycle and as such is also constrained by it. Precisely what

implications this information has for planning considerations will be discussed below. At this point, it is important to emphasize that the commercialization of animals does not occur randomly, but rather occurs in such a way as to meet the needs of pastoral production and of herders themselves in the best way possible given present constraints.

d. The Role of Marketing in Herd Structure and Composition Decisions. An examination of herd structure and composition also indicates the intimate relation between the pastoral production system and the market. Cattle are sold to meet large cash needs, while small ruminants are sold to meet smaller, more frequent expenses; thus, Sutter found that small ruminants accounted for over three-quarters of all sales but less then 35% of total revenue while cattle sales accounted for less then one-quarter of all sales but over 63% of all revenue (1979: 26). (Some of this diversification among Fulani is apparently a recent response to an increased demand for mutton in Nigerien markets. Sutter notes that "the Fulani, long considered cattle specialists, are increasingly raising and selling small stock, especially sheep" (1979: 26).) This trend may also in part be short-term. After the drought the rational way to rebuild herds probably was to begin with small ruminants: "sheep and goats are cheaper, they increase quickly in numbers, and they constitute a source of exchange value more readily realizable than cattle for current expenses" (Sutter 1979: 26). If it is true, as Sutter maintains, that herders' cash needs are increasing, this trend toward keeping small ruminants could be especially important if herders are to enter the market more frequently for small target needs.

Production rationality also prevails when a herder decides to sell an animal. Whenever possible he will sell an animal not necessary to herd reproduction or the maintenance of milk supplies. The sale of a productive female would imply not just a reduction of milk supplies available to the family but also a loss of capital and future investment in the herd (Sutter 1979: 27). Maliki reports that the WodaaBe judge the usefulness of an animal by three criteria: fertility, physical resistence, and milk production.

In terms of fertility, several kinds of animals are always sold: cows which seem to be reproductively normal but which do not conceive, cows which continually abort, sterile males and females, and males which do not have the physical characteristics to be good reproducers. In terms of physical resistence, chronically weak animals and ones that will not survive the dry season are sold before their value depreciates too far; as are those handicapped by disease or birth defect and cows over 8-10 years old. In terms of milk production, kinds of animals which are culled include cows with insufficient or no milk production, cows with atrophied teats, cows which consistently refuse to be milked or to give milk to their calves, and bulls which do not produce good milk producers (since the WodaaBe believe males are the carriers of crucial genetic traits linked to milk production) (Maliki 1981b: 105-106; as an incidental remark, Maliki's work casts some doubt on how many animals reported in the marketing statistics as "females of reproductive age" are in fact viable reproducers).

The tendency to regularly sell these elements of the herd indicates the extent to which marketing decisions are bound up with and have to be balanced against other kinds of considerations, namely the need to ensure milk supplies and the reproduction of the herd. This partially explains the comparatively low rate of commercial offtake (10-12%) which characterizes Sahelian livestock production. Nonetheless, there is no indication of sentimental unwillingness to part with these non-productive elements of the herd - on the contrary, herders do so readily in order to purchase basic commodities or acquire animals which will guarantee a better herd mix (i.e., sell two immature males in exchange for one producing cow, etc.).

B. DIMENSIONS OF MARKET INVOLVEMENT

Having demonstrated that pastoral production has a distinct market orientation as one of its faces, it is now important to examine certain aspects of this market involvement more closely in order to discern implications for planning consideration. Information about marketing is necessary at two levels: at the level of the individual pastoral enterprise, and at the level of aggregate pastoral marketing activities. NRL socio-economic research has begun to provide some of the detailed information about

production and marketing decisions at the household level which will contribute to a data base from which effective planning efforts can proceed. However, a review of research conducted thus far seems to indicate the existence of significant gaps in our knowledge of marketing in the project zone. The goal of this section, then, is both to pull out important themes from on-going research and to suggest areas where redirection of or re-interpretation of results from project research might be useful.

1. The Single Pastoral Enterprise.

The household budget studies among the WodaaBe and the Tuareg conducted by TSAs Cynthia White and William Fitzgerald will provide extensive data on a wide variety of subjects: sources of income for herding families, prices obtained from the sale of animals and pastoral products, prices paid for basic necessities, exchange arrangements within and outside the group, the quantity of cereals consumed by a given family, seasonal variation in (and the relation between) prices obtained for animals and those paid for basic necessities, and the periodicity of sales and purchases (White 1981: 7). The work of TSA John Curry in the agro-pastoral zone will reinforce many aspects of the data. Interpretation of results from these studies is still to come, but it promises to make a significant contribution to the identification of problems and the elaboration of solutions and to provide a method of predicting the consequences of different development strategies, including those in the area of marketing.

Presently, much of our knowledge of the relation between the single pastoral enterprise and the market comes from studies on commercialisation conducted by John Sutter (1978, 1979) from which major findings will be summarised here. One should note that interpretation of the household budget studies will permit a fuller assessment of the implications of trends identified by Sutter; this is of particular importance since the data presented by Sutter are highly suggestive but limited by small samples or by the exceptional dislocations of the 1969-1973 drought.

Changing Patterns of Expenditure.

The main thrust of Sutter's argument (1979) is that herders have become tied into relations of dependence and reciprocity with

sedentary communities by virtue of their increasing reliance on goods not produced within the pastoral economy for the satisfaction of their basic needs. This trend has serious consequences over the long term for herd productivity and subjects the single pastoral enterprise and the pastoral economy in general to external influences beyond herder control. Sutter is led to this conclusion from the following research findings. Comparative data on changes in family budgets (taken from M. Dupire's study in 1947, a major demographic survey conducted by SEDES/INSEE between 1962 and 1964, and Sutter's own study of 33 WodaaBe families in 1977-78) reveals three major trends: 1) between 1964 and 1978, there has been a fourfold increase in overall per capita cash expenditures, or 59% in real terms when inflation is taken into account; 2) the purchased food component of the budget has sharply increased relative to other expenditures, from 20% of total monetary outlay in 1947 to 66% in 1978; but 3) there is an immense relative decrease in tax expenditure due to the virtual elimination of taxes in the pastoral zone following the drought, which contributes to the exaggeration of other trends.

The increase in per capita grain consumption is a trend which is fairly difficult to interpret. Sutter (1979/ 19), comparing his data with that collected by the SEDES/INSEE study, demonstrates that daily per capita millet consumption has increased from 340 grams in 1964 to 438 grams in 1978. Since estimates of milk consumption or availability were not obtained, it is not clear whether this increase represents an increase in total food consumption <u>or</u> a progressive substitution of grain for milk. The latter interpretation is more probable, however, given the drastic reduction of herd sizes during the droughts of early 1970s.

A further difficulty is in knowing whether the shift to grain is permanent, or merely a post-drought necessity which will eventually pass. Herder demand for access to reasonably priced grain is unquestionably strong and represents one of the major areas where herders request assistance from the government (UNCC 1981). Response to this demand, however, has to be based on an adequate assessment of the nature of this increased market dependency.

Sutter maintains that this trend may have been intensified by the drought but that its effects may be longer term than pastoralists would like, if it is forcing the sale of productive stock. The household level research should help answer these questions.

Changing Sources of Revenue.

In order to understand this phenomenon, it is necessary to examine changes in the sources of income to purchase millet and other commodities. Two points should be made here. First, it seems that the exchange of milk products, at least in areas near markets and settlements, has been replaced by the sale of animals as the most important source of revenue within the pastoral enterprise. (There is some question whether exchange of milk products was ever of primary importance or whether this is just the pastoral ideal.) While studies conducted during the 1950s refer to the importance of the exchange and sale of milk products, in 1962-64, the SEDES/INSEE study found that 97% of average herder income was from animal sales. Sutter (1978: 25-26) estimates that 15 or 16 animals must be sold annually to meet a family's expenses. (In Sutter's (1979: 25) sample, he found an average of about 16 animals were sold per family during one year - typically 3 or 4 cattle, about 12 goats and sheep, one camel, and maybe one donkey).

Disinvestment?

The necessity of maintaining a relatively high level of animal sales in order to obtain basic commodities may force a herder to start selling productive elements of his herd, bringing on a "downward spiral of disinvestment" since the herder's capital itself must be sold. Sutter's (1979: 27-28) data seems to indicate that this process is presently occurring. Sales of heifers and productive females accounted for an abnormally high percentage of total animal sales in the late 1970s, at least in the Tanout area. That this process is not just an immediate post-drought reaction but has significant detrimental consequences is explained by Sutter as follows:

> To buy food that their drought-reduced herds cannot provide, herders are forced to further reduce their herds through sales, which in turn decreases the milk contribution to subsistence while further increasing the grain requirements of the family unit. The vicious cycle is thus set into motion (1979: 29)

If this trend is as significant as Sutter maintains, and the socio-economic team's budget studies will permit a new assessment of the severity of the problem (White 1981: 7), one point is clear: efforts to reduce the stress put on the pastoral enterprise by its increasing reliance on grain must fully address the problem, not just its symptoms. For example, making grain available to herders at low cost could help stop disinvestments , but if herd reconstitution capabilities are already impaired, other action may be called for as well. The general statement to be made here is that, since marketing patterns are largely an outgrowth of the pastoral production system itself, solutions to marketing problems must be based on a full understanding of the interaction of production factors.

Present Gap in Project Knowledge.

One area where the presently available data on the single pastoral enterprise is weak is on the implications of increases in animal production. At the moment, there is little evidence on the outcome of increased surplus from animal production in terms of consumption, reinvestment in the enterprise, or investment in other activities like commerce or crafts. This point is stressed by TSA Cynthia White (1981: 7-8), who notes that internal comparisons of data from the household studies will permit the identification of patterns to predict the outcomes of possible actions. For example, by comparing better-off families with worse-off families in their samples, the socio-economic team can ask, as productivity per capita increases, what changes occur in consumption, marketing, and investment patterns? It appears that grain, tea, and sugar consumption are among the first areas into which the increased surplus is channelled, but there is presumably a point beyond which this sort of consumption does not pass. If so, what is done with income generated by increased animal production? What areas of investment are chosen by the herder? "When" in saving cycles do herders invest in well-digging, salt or feed supplement purchase, more intensive veterinary care, etc.? TSA Fitzgerald notes that among the Tuareg, the richer the family, the more likely it is to spread animals among its relatives and neighbors; does this mean that commercial offtake rates will not increase with, or will rise slower than, the

level of animal production? Answers to these questions, which the budget study data should begin to provide, are critical if we are to understand the impact of production and productivity gains on the individual pastoral enterprise.

2. Aggregate Marketing Activity.

While research on the relation between the pastoral enterprise and the market is beginning to outline some important themes, we know considerably less about aggregate market activity, particularly the organization of the market chain itself.

Price relations between Agricultural and Pastoral Products.

Sutter's work (1979) has started to provide an understanding of price relations between pastoral and agricultural products in terms of annual variation, and the household budget studies will generate a picture of how this relation fluctuates seasonally. Further, the marketing study now being undertaken by CRED for the NRL will extend price and quantity studies across the zone.

> Sutter's data on macro-level price movements is important in that it shows how the pastoral sector articulates with other sectors of the economy. His major points are two: 1) a major determinant of the commercial offtake rate (and thus the volume of livestock trade) is the price relation between pastoral and other products, in turn largely explained by the success or failure of the millet harvest, and 2) although the terms of trade of nomadic - sedentary exchange (cattle for millet) fluctuate within wide parameters, in general they are not as unfavorable to pastoral products as is commonly assumed. Nonetheless, sharp frequent fluctuations in the terms of trade mean that herders always have to be prepared to vary quite radically the number of animals sold annually to meet their grain needs. For example, in the year immediately preceding the drought (1971), the amount of millet obtained from a single cattle sale was 1482 kg; two years later, rapid destocking coupled with a poor harvest pushed this figure down to 418 kg (Sutter 1979: 40).

While the drought years obviously represent an extreme situation, this example does indicate that sharp price variations can and do have serious implications for everything from commercialization rates to production-related decisions (i.e., maintenance of a herd large enough to have surplus animals to sell during a bad year).

Present Gaps in Macrolevel Knowledge about Marketing.

While we are gaining knowledge about price fluctuations and changes in the volume of trade, we know little about the institutional context within which this takes place, that is, the organization of marketing. There is hardly any information on the nature of market chains within the pastoral zone and between the zone and major markets in the sedentary zone of Niger and in northern Nigeria. TSA John Curry's work on agro-pastoralism in southern Niger is making some observations of the process, and Pierre Bonte's study in the zone between Madaoua and Birni N'Konni provides baseline material on prices, markets, traders, butchers, and exports in the pre-drought period (Bonte 1967). Robert R. Schneider's preliminary study (1980) of livestock markets in the northern and western part of the NRL zone starts to look at the macrolevel movement and marketing of cattle and the actors involved. He recognizes that a variety of questions need to be addressed, including market presentations, prices and pricing mechanisms, the bargaining power of sellers vs. buyers, the nature of market demand (local slaughter, local exchange, export), and the nature of marketing chains (nodes, transport factors, economies of scale, numbers and salience of links, the dynamics of control at every level).

Schneider's work was cut short, so that he offers not detailed data but a set of intriguing observations and questions. One interesting theme is the influence of proximity to Nigerian markets on marketing patterns in the project zone. The further south one goes, the smaller the percentage on animals slaughtered and the larger the percentage of animals exported to Nigeria as a proportion of total animals marketed. The important role played by proximity to Nigerian markets has several implications, from the fact that lower transportation costs from southern markets lead to higher prices with less variability to the fact that more buyers with more options and greater supply make it difficult for butchers to collectively determine prices as they do in smaller, predominantly slaughter markets. While our understanding of these relations needs to be deepened, Schneider's research clearly demonstrates the necessity of examining not only the way in which the single pastoral enterprise interacts with the local market, but the regional, national and international dimensions and dynamics of marketing patterns as well. The C.R.E.D. consultancy now under way should deepen this knowledge.

Other Aspects of the Livestock Industry.

Two further concerns about the marketing of Nigerien livestock should be raised here. First, a 1980 C.R.E.D. study shows that

earlier fears that Sahelian countries were losing their predominant position in West African coastal markets for meat after the drought proved to be unfounded. In the middle 1970s, inroads made by non-African suppliers were based on a phase in the worldwide beef production and trade cycle when world supply greatly exceeded demand and prices were accordingly low. This phase has now passed and Sahelian producers are once again in a competitive position in coastal markets. Moreover, new markets for Sahelian livestock may be opening up in North Africa and the Middle East (C.R.E.D. 1980: 4-5, 10-13).

The second issue concerns the rise in merchant-ownership of nomadic herds. The socio-econimic team's research has indicated that there has recently been an increase in the number of herds owned by merchants but tended by pastoralists who have no or few animals of their own, often as a consequence of the drought. In this situation, the herder gets the dairy products but not the offspring of the animals he tends in exchange for his labor - thus, while his subsistence is partially provided for, he does not have the opportunity to begin building a herd of his own. (See, for example, White 1981: 16-17.) Turning once independent herd owners into subsistence "wage" earners would obviously have momentous consequences for the pastoral zone, not just for the nature of production systems but for husbandry styles, offtake rates, access to services and many other crucial aspects of the pastoral economy. Clearly, further work is necessary to assess the implications of trade herds on herders and on development efforts. The implications for marketing are particularly strong, because if substantial herds are successfully being held on speculation relative either to short-term prices changes of longer-term growth possibilities, their impact on the viability of small producers may be overwhelming.

C. PLANNING CONSIDERATIONS

Efforts to improve the marketing of livestock in Niger must be directed at two levels: 1) strengthening the whole operation of the marketing system, and 2) strengthening the producer share in the overall livestock industry.

1. Strengthening the Whole Industry.

The first level involves everything from arrangements with coastal countries for trade in slaughtered meat to building more abbatoirs. Infrastructural development is particularly important in this light to ensure the efficient and inexpensive transportation of animals from producers to consumers. While many other projects have addressed both infrastructural and trade constraints, it is difficult to effect improvements in the overall marketing chain within the NRL zone without detailed knowledge of the linkages into the countryside.

In this chapter, we have stressed that livestock marketing patterns are a reflection of the interaction of a wide variety of factors (ecological, economic, social, subsistence); it follows that marketing interventions must be based on an adequate assessment of relevant factors and the relationships between them in order to effectively address the problems involved.

2. Strengthening the Producer Share.

The second planning consideration, strengthening the producer share in the livestock industry, can similarly be done in a variety of ways. Sutter (1978) writes that the sharp seasonal fluctuarions in the price of cattle presents both advantages and disadvantages for producers. If the constraints which force most herders to sell at the end of the dry season were removed through various kinds of interventions, peaks in the patterns of marketing activity could be smoothed, the downward influences on livestock prices would not be so acute, and herders could get more grain for their animals. Another way of strengthening the producer share might be to offer the herders means to fatten their animals before sale, increasing the weight and health conditions of the animal and thus raising its price. We return to this point below in a discussion of fattening as an element in the stratification of production. A third method of strengthening the producer share in the livestock industry might be to attempt to reduce the number of middle-shares in the marketing network. With adequate market information, access to transport, and the like, producers might get together and arrange to take their cattle to more distant markets where prices are more favorable, rather than sell at lower prices in a local market and have a series of

of traders benefit from the price differentials. The point of these kinds of efforts is to retain producer control over components of added value in the livestock industry which will enhance their bargaining position and provide new sources of income.

3. Stratification.

A major planning consideration which concerns not only marketing but production as well is the concept of 'stratification'. This concept gained currency with the Ministry of Rural Development and has inspired some preliminary studies conducted by other projects. Essentially, stratification is a theory of the reorgainzation of production in terms of the distribution of one major production factor, namely feed, as opposed to labor or capital (See FAO 1977). National policy recommends that production be stratified into three zones, running from north to south, each specializing in a different phase of production; The pastoral zone will be the 'zone of birth' (naissance), focusing on raising young animals for use further south. Production is to be a cow-calf operation, with all animals not necessary for herd reproduction sold immediately after weaning. In the proposed 'intermediate zone' where livestock and farming activities coexist, animals are to be purchased by the state or by agropastoral populations for 'growing-out' (ré-élevage) on government ranches or private farms. Finally, the agricultural zone will be the location of fattening activities (embouche); farmers will use agricultural and agroindustrial byproducts to help animals attain a maximum weight before final sale.

The theory of stratification, elaborated in a series of French-aided livestock reports across the Sahel from 1965-1975, has not informed NRL project activities, which took an initially skeptical stance on the feasibility and probable benefits of implementing such a strategy. Nonetheless, as it is part of national policy, it is important to examine here, and several pieces of research speak to some of the issues involved in stratification. Most of this research had consisted of studies on the third element of the policy, fattening programs in the south.

There have been two evaluations of the viability of existing programs. A 1977 C.R.E.D. study examined a cattle-fattening project in Liboré, in which 192 smallholders were given credit

to purchase animals for fattening. 54 smallholders who had sold their animals at the time of the preliminary evaluation, and their experience demonstrates that fattening is a profitable activity, yielding participants an average gross profit of 13,425 CFA (Wardle 1977: 5). (The profits, however, varied a great deal according to the initial purchase price and the total weight gain.)

While the preliminary results seem favorable, several serious problems presented themselves. The selection of participants was a particularly troublesome issue at two levels. First, attempting both to choose smallholders capable of repaying loans and to respect traditional authority, village chiefs were asked to select individuals who could participate in the program; consequently, favoritism played too important a role in the selection process (Wardle 1977: 5). Second, the need to ensure credit repayment meant that only those smallholders who could affort to participate (by paying the initial deposit, providing a sufficiently large supply of grass, and being able to keep an animal in the compound) were allowed to do so. Although not noted in the report, it is clear that equity considerations could not be guaranteed with such a system; new resources were made available to smallholders who had the resources to expand and diversify their activities while those who did not could not participate. The most serious problem with cattle-fattening in general is the fact that there is no large market for (quality) fattened animals. While fattening schemes such as the Liboré program offer new profit-making opportunities for some smallholders, encouraging cattle-fattening on a large scale would be useless given the high cost of airfreight and competition from foreign high-grade suppliers in coastal markets, and a prohibitive tariff on imported carcasses in Nigeria (p. 14). Unless these problems can be overcome, it appears that efforts to introduce cattle-fattening are heading into a 'cul-de-sac'.

A C.R.E.D./INRAN study conducted by Randall Thomas (1981) contains a more detailed comparison of three kinds of fattening and growing out programs in the Department of Zinder. First, there is the Embouche Bovine program, jointly supervised by the UNCC, CNCA and the Livestock Service. These three services purchase animals, allocate them to farmers on credit, provide technical assistance during the 4-month fattening period, and recuperate the loans upon sale at the end of the program. The second type is an existing private sector equivalent of the Embouche Bovine: a farmer purchases an animal during the harvest period, fattens it for a three to four month period, and resells it during the dry season. The third type is a sort of combination growing out and fattening scheme and is more common than the other traditional system. At the end of the dry season, when animal prices are low, a farmer invests in an animal, consigns it to a herder until after the harvest, and then fattens it for three to four months before resale.

Thomas's study shows that different rates of return exist for each type of program. Although based on relatively rough estimates his calculations clearly show that the rate of return for participants in the government-run Embouche Bovine program

> is higher than it is for either of the privately financed operations (approximately 19% compared to just over 15%). Moreover, traditional fattening requires a larger initial capital outlay and is a higher risk investment. As farmers are likely to recognize the more attractive investment opportunities, Thomas writes, "continuation of the Embouche Bovine program could be harming the development of private sector cattle-fattening efforts" (1981: VII-1).

Whether or not government efforts could be directed to those poor people who cannot afford the entry costs of private fattening, or towards women, remains to be explored.

While a fair amount of research has been done on fattening programs and their potential benefits demonstrated, little is known about the viability of an intermediate zone for growing out (ré-élevage) activities. In fact, Thomas's examination of traditional growing-out and fattening activities seems to be one of the only efforts made to test the concept of an intermediate zone. Thomas (1981: VI: 5-6) says that government loans for growing-out more or less as it is currently practiced is an idea that should be considered; since the system works relatively well now, it could be strenghtened with government support. Nonetheless, he continues, several problems must be ironed out before such a program could proceed. For example, to what extent can agropastoral areas support increased numbers of cattle? How equitable is it to use herders as poorly paid guardians of village cattle? And, of course, the administrative and financial aspects of such a program need to be worked out. In short, then, the viability of the concept of an intermediate zone remains problematic.

Finally, there is the issue of the pastoral zone as the zone of birth. No work has been done on this issue; moreover, no one can conceive of evidence which would support an argument for the economic rationality of cow-calf operations in Niger or elsewhere in the Sahel. Net returns to keeping male animals in the herd after weaning and until maturity seem quite high, while keeping females for reproduction and subsistence purposes is of obviously top priority to the herders.

Perhaps the most significant gap in the research about stratification is the lack of attention paid so far to equity considerations. We have an adequate understanding of the increased profit margin resulting from cattle-fattening activities but we need to know overall who would gain and who would gain how much. The value-added at each

phase must be calculated in order to ensure that the benefits of any reorganization of production would be shared equitably. For example, while capital support from government for fattening and eventually growing-out programs clearly gives farmers access to new sources of income, it is not so clear how herders stand to benefit from converting existing pastoral production into a cow-calf operation in the hypothetical "zone naisseur". Demonstrable and quick profits earned from an activity supplemental to the practice of agriculture provide incentive to farmers to participate in the stratification of livestock production. For herders, however, the transformation to the zone of birth is said to imply less tangible but more pervasive (and higher risk) changes in the production system. It is said that increased commercial offtake would mean fewer animals exerting less pressure on scarce pasture resources; thus, remaining animals would be healthier with better calving rates and increased milk production. (In fact, a summary of the USAID SODESP (n.d.: p2) project in Senegal cites increased milk production and better calving rates as the prime incentives for herders to join the stratification program.) All of this sounds good in theory but remains to be evaluated or tested in practice. It might be, for example, that an overall increase in the commercialization rate would exert a strong negative influence on the price of livestock, so herders would need to sell even more animals to purchase the same amount of millet and no increase in their standard of living would result. Although the costs and benefits of creating a zone naisseur remain to be fully assessed, it might be preferable to at least consider directing growing-out and fattening programs at herders themselves, allowing them to profit from the strengthening of the livestock industry rather than allocating strengthened facets of livestock production and marketing to populations outside of the pastoral zone.

BIBLIOGRAPHY

Note: This bibliography is divided into four parts. The first consists of materials prepared specifically by or for the NRL itself. Internal memoranda are identified by title and date. Part B includes other documents of the Government of Niger and its agencies. Part C includes other documents prepared by or for U.S.A.I.D., or with U.S.A.I.D. funding. Part D comprises published and unpublished scholarly works. All citations are in the language of the document as consulted.

A. NRL DOCUMENTS

Bachir Boukary
- 1980 Rapport de Mission Effectué du 22 au 29 Décembre 1980 dans les Départements de Zinder et Agadez.
- 1981 Rapport: Seminaire Projet FAO de Formation Tahoua du 1er au 7 Octobre 1981.

Bement, Robert E.
- 1980 Report to Dr. Ali Dankintafo for the NRL Project (March 26).
- 1981a Report to Dr. Ali Dankintafo for the NRL Project (April 9).
- 1981b Report to Dr. Ali Dankintafo for the NRL Project (September 9).

Blaine, David
- 1981a Recommendations for Phase II NRL ("first draft").
- 1981b An Association (March 1981.

Butchart, Douglas W.
- 1980 Niger Range and Livestock Project - Trip Report, September 15.

Curry, John
- 1981 Summary of Goals and Activities of Agropastoral Study for Mid-term Evaluation, July 15.

Fitzgerald, William
- 1981 Present Status of Socio-Economic Studies: Tuareg Section (July 12).

Hussel, Karen M.
- 1981 Summary of Work Completed (July 4).

Knight, Jim
- 1980a Report of Activities, July 1980 (29 July).
- 1980b Summary Report, Phase I Water-point Survey (24 June).
- 1980c Animal Predation Study (29 July).

Knight, Jim
1981a Report of Activities during December 1980 (17 January 1981).
1981b Report of Activities for January 1981 (12 February 1981).
1981c Report on the feasibility of the experimental attribution of water rights at new or improved water sources in the NRL zone (18 February).
1981d Report of activities for February 1981 (17 March).
1981e Report of activities during March 1981 (27 March).
1981f Report of activities during May 1981 (3 June).
1981g Summary of work to date and in progress (evaluation briefing paper).
1981h Discussion Paper: Policy Considerations for NRL Phase II planning (September 1981).
1981i Herder Cooperatives in the NRL zone (5 Ocotober).

Loutan, Louis
1981a Pratiques Traditionelles chez les WodaaBe (Peuls Borroro): les Maladies, les traitements (janvier 1981).
1981b PGPE: Volet Nutrition et Sante (juille 1981), Analyses de l'Enquete Nutritionelle.
1981c Autoencadrement sanitaire en milieu éleveur: Quelques résultats de Tchintabaraden (août 1981).
1981d Quelques réflexions sur la formation de sécouristes éleveurs à Tchintabaraden (août 1981).
1980a Pratiques Traditionelles chez les Peuls WodaaBe (Bororo): La Grossesse, l'Accouchement, l'Allaitement (décembre 1980).
1980b Resume des activities de la periode s'entendant du 27 octobre au 7 décembre 1980 (10 décembre)
1982 Human Health and Nutrition in the NRL Project Zone: Discussion paper No. 1.

Maidaji, Bagoudou
1981 Rapport de fin de stage, period 17-6-81 - 16-7-81, in country training.

Maliki, Angelo B.
1981a Etude socio-démographique sur la population WodaaBe et Fulbe de la région du projet NRL.
1981b Ngaynaaka: L'Elevage selon les Wodaabe. Discussion paper No. 2.

Milligan, Kevin
1981 Aerial Survey of Human, Livestock and Environmental Conditions in a Central Region of the Pastoral Zone of Niger (Preliminary Report No. 1, July 1981). International Livestock Centre for Africa.

Mouhamadoune Abdourabahi
1981 Des auxiliaires vétérinaires à Tchintabaraden (10 août 1981).

Niger Range and Livestock Project
1977a Project Paper: Niger Range and Livestock Project (683-0202).
1977b Project Grant Agreement between the Republic of Niger and the United States of America for Niger Range and Livestock.
1980 Rapport d'Activités, Annee 1980 (Avril 1981).
1981a Rapport d'Activités, Annee 1981 (Novembre 1981).
1981b Project Evaluation, September 1981.

Oumarou Alpha Noma
1980 Compte-Rendu de la Tournée (O.P.V.N.).
1981a Rapport de Tournée, le 6 janvier.
1981b Rapport de Tournée, 23-30 janvier.
1981c Rapport de Tournée du mois de mars 1981.

Riddell, James C.
1979 Preliminary Notes on Land Tenure issues in the NRL Project Zone. University of Wisconsin: Land Tenure Center, Mimeo (February 23).

Rupp, Marianne
1976 Observations sur la Situation Générale des Eleveurs après la Secheresse (June 1976)

Schneider, Robert R.
1980 Preliminary Study of the Livestock Market in the Western Zone of the Niger Range and Livestock Project. Mimeo.

Simpson, Roy
1981 Report for Evaluation Team (July 15).

Socioeconomic Team
1980 Le Developpement de l'Elevage et des Associations d'Eleveurs.
1981 Statuts des Associations Pastorales: Texte Provisoire (Décembre 1981).

Sollod, Albert E.
1981a Veterinary Mission, April-May 1981: Interim Progress Report.(30 May 1981)
1981b Combined Internal Parasite and Tick Survey with Clinical Correlations.
1981c Development of Disease Survey and Disease Control Capabilities in the Niger Livestock Service. (30 May 1981)
1981d Interim Report - External Parasites: Dry season incidence. (May 1981).
1981e External Parasite Infestations of Livestock (May 1981).
1981f Veterinary Report F: Mortality in Small Ruminants (30 May 1981).
1981g Mission veterinaire, Juillet à Septembre 1981 (4 September 1981).
1981h Patterns of Disease in Sylvopastoral Herds of Central Niger (November 1981).

Sutter, John W.
1978 Pastoral Herding in the Arrondissement of Tanout: A Socioeconomic Study Prepared for the NRL, Livestock Service, MDR. Zinder, August 1978.

Swift, Jeremy
1980a Report of Field Trip, 3-22 March 1980 (April 10).
1980b Gaps in Project Work (18 June)
1980c Formation of Pilot Herders Associations (November 18).
1980d NRL Socioeconomic Unit - 2nd Revised Work Plan (November 1980).
1980e Status and Evaluation of Socio-Economic Work (November 20).
1981a Report of Field Trip, 26 February to 25 March 1981 (April 12).
1981b Project Liaison with UNCC.
1981c Report of Mission in Niger 14 to 28 October 1981 (October 27).
1981d Report on Consultant Visit to Niger - 25 November to 23 December 1981 (December 21).

Thomson, James T.
1981a Nigerien Herder Associations: Institutional Analysis and Design.
1981b Nigerien Herder Associations: Institutional Analysis and Design (Executive Summary) (September 3).

White, Cynthia
1980a Report of Activities (May-July).
1980b Report of Activities (August-October).
1981 Description of Socioeconomic Studies on the Fulani (July 15).

Zangui, B. Issoufou
1980 Rapport de Tournée, 1er au 12 Décembre.
1981a Compte Rendu de la Tournée du 18 au 26 février 1981.
1981b Compte Rendu des Tournées sur les points d'Eau, 22 mai 1981.
1981c Compte Rendu de l'Enquête sur les Puisatiers.

Wylie, Bruce
1981a Range Management Report: Theories and Ideas (June 1).
1981b Report of Dry Matter Production under four Intensities of Clippings (November 17).
1981c Report on Changes in Numbers of Individuals for four Grass Species throughout the 1981 Rainy Season (November 18).
1981d Report on Changes in Plant Species Numbers under four Intensities of Clipping at Ranch Nord Dakoro (November 1981).

B. OTHER GOVERNMENT OF NIGER DOCUMENTS

Ari Toubou Ibrahim
1978 Lecture at the Seminar on the Administration of Cooperatives, organized by the ACCT. Republic of Niger: Ministry of Rural Development, December 1978.

Government of Niger
1980a Projet de Developpement de l'Elevage dans les Departements de Maradi-Zinder-Diffa (Projet Elevage Niger Centre Est). Ministry of Rural Development, Livestock Service, Mimeo.
1980b Note du Presentation du Projet Elevage Sud-Tamesna (Ministry of Rural Development, Livestock Services, Mimeo.)
1981 Arrete n° 18/MDR: Portant sur l'Orgainsation des Eleveurs en Zone Pastorale (3 avril 1981).

I.B.R.D.
1978a Niger Livestock Project, Working Document No. B-1, Social Analysis (Doc. No. 124060 (B1-6) C2).
1978b Etude de la Factibilité Technique du concept d'unités pastorales au Niger (Arrondissements de Tanout et Goure) (décembre 1978). Maisons-Alfort: I.E.M.V.T. pour I.B.R.D.
1979 Niger: projet d'Elevage: Projet d'Evaluation (Rapport No. 2169-NIR).

U.N.C.C.
1981 Compte-Rendu de la Tournée des Membres de la Commission de Reflexion sur la Stratégie du Developpement du Mouvement Cooperatif- Zone I - Nord des Départements de Tahoua, Agadez, Zinder et Diffa, du 26 janvier au 28 février 1981.

C. OTHER USAID REPORTS

Centre for Research on Economic Development
1980 Livestock and Meat Marketing in West Africa, Vol. I (Synthesis). Ann Arbor: University of Michigan.

Eddy, E.D.
1976 Rapport Annuel, 1976. Projet de Recherches sur l'Economie des systemes de Production dans la Zone Pastorale Sahelienne du Niger. I.N.R.A.N.: Mimeo.

USAID/NIGER
1979 Niger Agricultural Sector Assessment, Warren J. Enger, ed. Volume I: Synthesis, Vol. II: Annexes.

USAID/Sahel Development Program
1981 Sahelian Livestock Industry Status and Development Strategy. May 1981.

USAID/Senegal
1979 SODESP Background.

Shapiro, Kenneth H., ed.
1979 Livestock Production and Marketing in the Entente States of West Africa: Summary Report. Ann Arbor: University of Michigan Center for Research on Exonomic Development.

Thomas, Randall
1981 The Stratification of the Production and Marketing of Livestock in Southeastern Niger in the Department of Zinder: Preliminary Report of Results (May 1), (CRED-INRAN study).

Wardle, Christopher
1977 Smallholder Cattle-Fattening Project in Liboré, Niger: Activity Report from September 1976 to February 1977 (February 1977). Republic of Niger: Ministry of Rural Development.

D. SCHOLARLY WORK

Bernus, Edward

n.d. Human and Animal Diseases (among) the Sahelian Touareg. Mimeo of English translation: no translator given.

1974 Les Ilabakan (Niger): Une tribu Touaregue Sahelienne et son aire de nomadisation. Paris: ORSTOM.

1977 Les Eleveurs face à la Sècheresse en Afrique Sahelienne: Exemples Nigeriens. In David Dalby, R.J. Harrison Church, and Fatima Bezzaz, eds., Drought in Africa 2 (African Environment Special Report 6). London: International African Institute.

1981 Les Touaregs. Paris.

Bonte, Pierre

1967 L'Elevage et le Commerce du Betail dans l'Ader Doutch-Majya. Etudes Nigeriennes N° 23. Niamey et Paris: I.F.A.N./ Niger and E.N.R.S.

Boudet, G.

1977 Les Pâturages Saheliens: Les dangers de dégradation et les possibilités de régénération: Principes de gestion ameliorée des parcours Saheliens. Annex IV of the F.A.O., les Systèmes Pastoraux Sahelians. Rome: Food and Agriculture Organization.

Breman, H., A. Diallo, G. Traore, and M.A. Djiteye

1978 Ecologie de la transhumance du gros betail au Sahel. Presentation sur 1ere "International Rangeland Congress," Denver, August 1978. Traduit par L. Blaauw et A.M. Cissé.

Breman, H.

1981 Rangeland Productivity and Exploitation in the Sahel. Center for Agrogiological Research, University of Wageningen, The Netherlands. Mimeo.

Dahl, Gudrun and Anders Hjort

1976 Having Herds: Pastoral Herd Growth and Household Economy. Stockholm: University of Stockholm, Department of Social Anthropology.

Dupire, Marguerite

1962 Peuls Nomades: Etude descriptive des WodaaBe du Sahel Nigerien. Paris: Université de Paris, Travaux et Memoirs de l'Institut d'Ethnologie LXIV.

F.A.O.

1977 Les Systèmes Pastoraux Saheliens. Rome: Food and Agriculture Organization.

Klein, H.D., I. Keita, and J.G. Mesnil

1981 Trois Années d'Activités Agropastorales en République du Niger: Production et Valorisation des Pâturages Saheliens (Ranch d'Ekrafane) et des Fourrages Irrigués (Station de Kirkissoyé). Mairons-Alfort: Institut d'Elevage et de Medecine Vétérinaire des Pays Tropicaux (pour I.N.R.A.N., Niamey), (Mars 1981).

Nicolaisen, Johannes
1963 Ecology and Culture of the Pastoral Tuareg. Copenhagen: National Musemum.

Pratt, D.J. and M.D. Gwynne, eds.
1977 Rangeland Management and Ecology in East Africa. London: Hodder and Stoughton.

Raulin, Henry
1976 Organized Cooperation and Spontaneous Cooperation in Africa (Niger Republic). In J. Nash, J. Dandler, and N.S. Hopkins, eds., Popular Participation in Social Change: Cooperatives, Collectives, and Nationalized Industry. The Hague: Mouton Publishers. Pp. 35-43.

Rippstein, G. and B. Peyre de Fabregues
1972 Modernisation de la Zone Pastorale du Niger: Etude Agrostologique, N° 33. Maisons-Alfort: Institut d'Elevage et de Médécine Vétérinaire des Pays Tropicaux.

Sutter, John
1979 Commercial Strategies, Drought and Monetary Pressure: Wo'daa'Be nomads of Tanout Arrondissement, Niger. Cornell University, October 1979. Mimeo.

Swift, Jeremy J.
1979 The Economics of Traditional Nomadic Pastoralism: The twareg of the Adrar N Iforas (Mali). Unpublished Ph.D. dissertation, University of Sussex.

Niger Range and Livestock Project Discussion Paper Series

Since 1979, the Niger Range and Livestock Project, jointly administered by the Government of Niger, the Ministry of Rural Development, and USAID, has conducted extensive research in the pastoral zone of Central Niger. The project's final report of research findings will be published in December 1982.

The discussion paper series, of which this report forms a part, presents preliminary research results, consultants' reports, and selected chapters of the final report. These papers represent the perspectives of their authors and do not necessarily reflect the position of the Government of Niger or USAID.

Other titles in the discussion paper series are:

1. Health and Nutrition in A Group of WoDaaBe (Bororo) Herders in Central Niger.
2. Ngaynakka: Herding According to the WoDaaBe.
3. Introduction to the History of the WoDaaBe.
4. Animal Diseases Patterns in the NRL Project Zone.
5. Toward Development for Pastoralists in Central Niger: an Interim Synthesis Report of the Work of the NRL Project.
6. Nigerien Herder Associations: Institutional Design.
7. The Market for Livestock from the Central Niger Pastoral Zone.

It is hoped that the circulation of these discussion papers will generate commentary and dialogue.

Director, Niger Range and
Livestock Project
B.P. 85
Tahoua, Niger