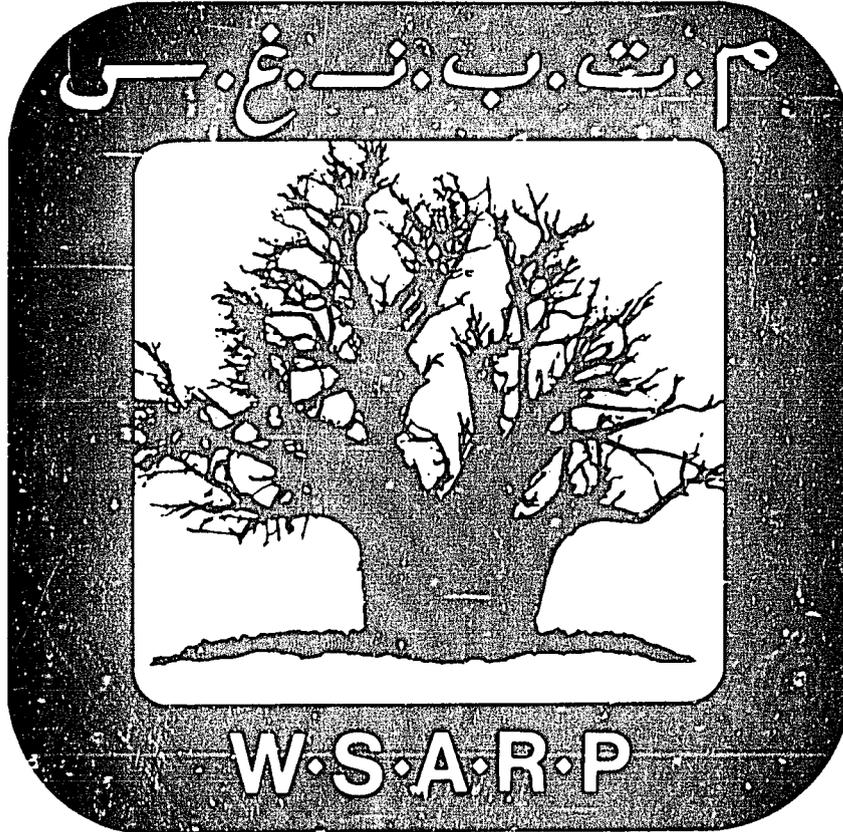


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AGRICULTURAL RESEARCH CORPORATION
WESTERN SUDAN AGRICULTURAL RESEARCH PROJECT



SOCIAL SCIENCE REPORT
FEBRUARY 1982 - MARCH 1983
KADUGLI RESEARCH STATION

WSARP PUBLICATION No. 25

AUGUST 1984

AGRICULTURAL RESEARCH CORPORATION
WESTERN SUDAN AGRICULTURAL RESEARCH PROJECT

THE GOVERNMENT OF SUDAN
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
THE WORLD BANK
CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
WASHINGTON STATE UNIVERSITY

SOCIAL SCIENCE REPORT
FEB 1982 - MARCH 1983
KADUGLI RESEARCH STATION

JOEL M TEITELBAUM

SOCIAL SCIENTIST

WSARP PUBLICATION No. 25

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6

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IS SUPPORTED BY

THE GOVERNMENT OF SUDAN
THE AGRICULTURAL RESEARCH CORPORATION
US AGENCY FOR INTERNATIONAL DEVELOPMENT
THE WORLD BANK

THE USAID PORTION OF THE PROJECT IS BEING IMPLEMENTED BY
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TUCSON, ARIZONA, USA
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REPORT OF SOCIAL SCIENCE RESEARCH ACTIVITIES

KADUGLI RESEARCH STATION

February, 1982 - March, 1983

by

Joel M. Teitelbaum

I. INTRODUCTION

During this reporting period (February 1982, through March, 1983) Social Science activity at the WSARP Kadugli Station included a variety of research-related efforts by the senior Social Scientist during most of 1982 and early 1983, and by other staff during the last quarter of 1982 and early 1983.¹

In the first few months on station, the Social Scientist made exploratory visits to farmers' fields and pastoralists' herds in South Kordofan, learned about the cultures of the Nuba Mountains area and learned the local

¹ Staffing Pattern in Social Science at Kadugli Station during the report period:

1. Dr. Joel Teitelbaum, WSU/WSARP Social Scientist (from February, 1982, through March, 1983)
2. Mohamed Abu-Sabah, Assistant Scientist (Month of May, 1982)
3. Mahmud Mekki, Assistant Scientist (Trainee) (from September, 1982, through March, 1983)
4. Barbara Michael, Associate-in-Research, WSU (from October, 1982, through March, 1983)
5. Ahmed Ali Ahmed, Junior Technician (from December, 1982, through March, 1983)

Arabic dialect. Available secondary literature sources were consulted in detail. Interdisciplinary field visits were made to households in villages and nomadic camps with the Animal Nutritionist, Range Scientist, Agronomist (Station Director). In May, with the WSU Agricultural Economist, a week-long fieldwork observation visit was made to a research site in Northern Kordofan where INTSORMIL social scientists were carrying out a Farming Systems research effort. (See Reeves and Frankenburger publications listed in the References Section of this report.)

Preparation of research proposals in collaboration with all Kadugli Station staff began in June, 1982. Completed proposals (with interdisciplinary input) were submitted in October, 1982, for socio-economic research on the Sedentary and Transhumant Systems of South Kordofan. The Transhumant Panel Study (WSARP Study No. 15) was written by the Senior Social Scientist. Study No. 2, the original Sedentary Farmer Study was jointly written by the Senior Agricultural Economist and the Social Scientist as co-principal investigators.

Exploratory research continued, but was limited during July and August, due to transportation problems. Recruitment of social science staff and trainees took place during these summer months. Meetings with project leadership from the Khartoum WSARP office and Washington State University took place in April and October to plan project strategy. The writing of the Kadugli Workplan and the WSARP General Research Programs and Plans took place from August through October. In September, 1982, the new research station site at the Seraf El-Ahmar opened and the station staff moved there to initiate research operations.

Two new staff members in Social Science arrived in September-October and received orientation. In November the Mid-term Evaluation of WSARP took place with Social Scientist participation. Staff meetings followed in early December; the Social Scientist was on leave at the end of 1982. From January, 1983, field research on the transhumants began again.

February and March were active months for interdisciplinary research with traditional farmers in preparation for on-farm trials of crops, and with transhumant households on the Seraf El-Ahmar, within walking distance of the Station. In February, the Social Scientist delivered a paper at the Desertification Workshop at the University of Khartoum (See Appendix I).

This report covers more than fourteen months in Sudan, about one full year of which was spent at Kadugli Station by the Senior Social Scientist. Contributors to the report include Mohamed Abu-Sabah, Assistant Scientist; most of his time was spent in Khartoum preparing his Master's Thesis in Social-Anthropology on South Kordofan's Abyei area farming and social system of the Ngok Dinka. The Associate-in-Research, Barbara Michael, spent nearly five months at Kadugli Station (from October, 1982, to March, 1983) within this report period. During this time she acquired the local Arabic dialect and became acquainted with field conditions and cultural contexts. She prepared and submitted her Ph.D. Dissertation Proposal and WSARP/Kadugli Research Plan (See Appendix III). She identified the transhumant camp she planned to work with. Ms. Michael took the lead in a brief intervention on firewood collection by transhumant women (See Appendix II).¹

This report contains an interdisciplinary social science reference list (See Section III) with nearly two hundred citations compiled by the Social Scientist and Associate-in-Research. Many such secondary sources are invaluable aids in WSARP research. Some have been acquired by the Kadugli Library at the Station. However, the bibliography should serve as a basis for ordering a more complete set of holdings essential to WSARP interdisciplinary and social science research. Citations in the report text are detailed in this References listing.

¹ The author wishes to acknowledge contributions to this report by Associate-in-Research Barbara Michael in the Results portion of the Transhumant Production Systems study, Section 4, Subheading, "House Construction and Use: Physical Arrangements of the Fariq" and Section 5, "Gender, Role and Labor Allocation." Also the itemized list for Quality of Life Index and portions of the Seasonal Cycle Tables. Responsibility for the contents of the entire report rests with the author, but credit is given to each contributor for inputs. Also, suggestions by interdisciplinary team researchers are acknowledged here, and in the text, especially Dr. Babo Fadlalla (Animal Nutritionist) and Dr. W. Trent Bunderson, (Range Scientist) at Kadugli Research Station.

II. RESEARCH ACTIVITIES

A. TRANSHUMANT PRODUCTIONS SYSTEMS PANEL STUDY - A Diagnostic and Monitoring Study of the Organization and Household Management of Migratory Herding and Cultivation in the Central Districts of South (and North) Kordofan, and the Impact of Change.

1. Scientific Staff included:

Principal Investigator: Dr. Joel Teitelbaum

Co-Investigators: Dr. Babo Fadlalla, Animal Nutrition,
Dr. W. Trent Bunderson, Range Science,
Dr. Richard Cook, Animal Production,
Ms. Barbara Michael, Associate-in-Research, and
Mr. Mahmud Mekki, Social Science Trainee

2. Time period covered is from November 1982, through March 1983, at which time the studies were ongoing.

3. Procedures and Results

a. Research Approach

This is basically a diagnostic and intervention-monitoring study, with the major aspect of the study to better describe and define the transhumant production system for livestock and crops in the Kordofan target area. The study detected incentives to and constraints on production related to transhumance as a preferred mode of production and way of life. It analyzed factors that promote "nomadization" of settled farmers and "sedentarization" of transhumant households. The procedures were mainly by informal survey techniques, and longitudinal (time-series) observation of a panel of transhumant households and analysis of case studies of each type of transhumant household mentioned above.

Research took place in the transhumant camps, with their herds on-range, and at their cultivation sites, as well as during the transhumant trek. As a farming systems field research effort, the results are largely descriptive in nature. Zoning and diagnosis were essential steps before verification, which is optional. This study addressed certain hypotheses for WSARP based on a major research question,¹ as follows:

The major research premise is that social and economic factors in the organization of transhumant camps and households are key to the nomadic production system as a way of life; i.e. to what extent does transhumance depend on entire households participating as part of a larger production unit, the camp or fariq, supported by the tribal social structure of the participants. Based upon these considerations, the following hypotheses were developed:

(1) First Hypothesis:

That variables identified as perpetuating the transhumant system also control the processes of sedentarization and nomadization. These variables can be manipulated to bring about desired production changes including: better management of herds, more efficient labor allocation in households, and environmental stability (through improved control over the natural resource base).

(2) Second Hypothesis:

That the introduction of socially sound and economically feasible technical interventions at the household and camp level can both improve production and lead to greater commercial offtake of livestock through existing market channels.

¹ As formulated here, these hypotheses fit a Social Science/Farming Systems approach. They are diagnostic and aimed at human factors rather than highly specific controlled experiment (null hypotheses). Useful comments on hypotheses came from Dr. Jean Kearns, CID and are incorporated here.

(3) Third Hypothesis:

The study will test the broader WSARP strategy that sustainable rangeland productivity in South Kordofan favors the maintenance of transhumant livestock in the Nuba mountains region (Southern District) during part of the rainy season, and that intensive grazing on North Kordofan soils cannot be sustained, due to environmental losses. The specific hypothesis is that transhumants can respond to this comparative advantage by gradually increasing the time spent in the south, if certain biological and economic constraints can be overcome.

The goals of this research project include:

(1) to provide a written description that best defines the transhumant production system in an interdisciplinary farming systems context. This includes the identification and prioritization of constraints and their interactions in-herd and on-farm.

(2) to prepare a longitudinal (time-series) data set on a small panel of transhumant households that can be used to monitor the impacts of change through WSARP interventions, and to develop recommendation domains, i.e. homogeneous types of household groupings subject to similar interventions.

(3) to assist in generating interdisciplinary interventions that are socially sound, economically feasible and appropriate to the cultural perceptions of transhumants.

(4) to assess the marketing channels for livestock offtake and consumption by transhumant households.

(5) to develop elements for an index of quality of life for transhumants as they perceive it. This index is to be used in measuring project impacts on households.

This research had four overlapping phases. Phase I (from November, 1982) was a zoning and reconnaissance survey of transhumant camps in the dry season. This was followed by Phase II diagnostic interviews with panel households from February, 1983. From July, 1983, Phase III initiated follow-up on households previously interviewed during Phase II during their northward migration and their return to the south by the end of 1983. Phase IV, consisting of monitoring WSARP interventions and their interactions with constraints was expected to begin in 1983, and continue into 1984. The activities were to be completed by June, 1984.

This panel research effort will continue with a limited group of transhumant households over a complete migratory seasonal cycle. The households will be stratified according to three major criteria: (1) the number of large livestock (cattle) per household--divided into large herds, middle-size herds, and small herds (dividing points to be determined by natural clusters of herd numbers); (2) the type of household, i.e. transhumant mainstream, of transhumant tendency (nomadizing), or of sedentary tendency; (3) the cultural characteristics of the households, meaning their tribal identity and values associated with livestock and farming.

Three illustrative case studies of specific types of households were planned, using the anthropological method of participant-observation as well as more quantitative demographic data. The three case-types are:

(1) a transhumant Hawazma household that maintains its migratory pattern in a regular orbit and demonstrates the operation of interactive constraints and opportunities for production for mainstream transhumants. This case is being studied.

(2) a sedentary tendency household that has begun to settle out of the transhumant stream and adapt to more limited movement of household and herds in South Kordofan. Study of this case will begin in Phase III.

(3) a formerly settled household, preferably of Nuba tribal background, which has entered the transhumant system recently and is adapting to migratory practices to an increasing extent. This case has not yet been chosen.

Although concentration on the study of herd management tends to be on cattle herds, this study was also designed to collect relevant information on small ruminants (goats and sheep). Beasts of burden such as camels and donkeys are being accounted for in the migratory process and for transportation use and cultivation.

Social marketing is an approach to the study of the transhumant household members' relationship to the markets for livestock and consumption items, and the division of labor in marketing behavior. This component is critical to an understanding of market channels, and incentives and constraints on the sale of livestock. This topic area also involves a study of gender roles in livestock marketing. Linked to the system of ownership rights is market sales of household herds. The procedure includes investigating the disposition of the proceeds of livestock sales, including reinvestment in animals, expenditures for costs of production, and household consumption. The Social Scientist is studying the role of men in livestock marketing, and the Associate-in-Research is focusing on the role of women in marketing livestock products and in household consumption.

A simplified index of the quality of transhumant life and measures of change in consumption patterns will be constructed. This will be used in measuring the impact of project interventions among producer households. An inventory of the household goods in transhumant fariqs (camps) and their other possessions has been carried out during the dry season. It is expected that a consultant will be engaged to develop a simple-to-use index that can be employed to compare the standard of living of transhumant and sedentary households over time.

The topics covered in panel household interviews using an informal diagnostic approach are as follows:

(1) Cultural characteristics and social composition of transhumant camping groups by season; the scheme of relationships between households in each camp.

(2) Household demographics, kinship network and chronological history of each household's pattern of migration and tendencies.

(3) Data to be drawn from Range-Livestock scientist (Bunderson, WSARP) data-base include: livestock census including herd size and composition from season to season and age/sex structure of typical herds.

(4) Herd management techniques will illustrate: preferred grazing patterns and watering patterns by season; migratory options for movements of herds; perceived attractions of transhumance for herd management.

(5) Social marketing practices will describe: livestock sales and purchases by season and location; gender roles in sales of livestock products; incentives for offtake due to price differences; market-related constraints on improved productivity of herds and flocks.

(6) Labor supply and the division of labor in herding and transhumant cultivation will emphasize labor-related constraints on livestock and crop production and household age-sex roles.

(7) Economic resources and costs include fixed economic assets and movable assets; income from herds and outside sources of income; and transhumant style of life and consumption costs vis-a-vis investment in herds.

(8) Transhumant household variations in production strategies and openness to improved modes of livestock raising will be examined.

(9) Cooperative linkages will be described between transhumant households and associated sedentary households through livestock, labor supply and crop cultivation, via sharing of resources and mutual aid, and the effects of these networks on production.

(10) Constraints to production that result from inter-tribal and inter-group conflict within the transhumant system will be identified especially tied to competition for land use and water with settled farming groups and costs of settling disputes.

(11) Livestock and crop-related government services and interventions affecting the productivity of transhumant activities will be itemized.

(12) Acceptability of improved range use patterns to transhumants in light of WSARP research findings will be assessed.

Key constraints to livestock production of an ecological and biological nature have been described in the WSARP Workplan for Kadugli Station (1982), in the Annual Report of the Range Scientist (1981), and in research proposals by the WSARP range-livestock scientists in nutrition, animal production and range science. However, except for a generalized description of the transhumant cycle in the Workplan, the social and economic factors that constrain transhumant system output have not been identified and prioritized or examined interactively with biological factors. Also, the area of inter-group conflicts is an unresearched source of constraints. WSARP Social Science activities will concentrate on these constraints and their interactions.

One useful procedure is collaboration with Sudanese government agricultural and social scientists in the Ministry of Agriculture, the universities, and with policy-makers in the Kordofan Regional Government. More information can be gained this way to complement that discovered by WSARP diagnostic procedures. This research activity included some study of policy

constraints; it looks at policy implications that could strengthen the productive capacity of the transhumant system, but is not a Farming Systems Policy study.

During the first phase of the study, a case of violent conflict involving households in the panel sample occurred and is being followed longitudinally. This case illustrates the interaction of different types of constraints, land use, water access, social relations, and economic impacts in their cultural context and the role played by the tribe and the government. These complex interactions appear to have a systematic effect on production.

Three main types of benefits should emerge from this study, for WSARP and for the transhumant producers of South Kordofan. First, are the benefits of gaining an understanding of the social and economic dynamics of the transhumant system across the cycle of seasons and movements, so as to identify areas of comparative advantage for interventions. Second, interventions can be designed better if tailored to the perceived needs of transhumant households and their value system to be elicited in this research work. Third, is the benefit to producers to be measured by monitoring WSARP interventions to determine their degree of success. The study will also make possible an index of quality of life for transhumant households with which to measure the impacts of technical improvements in production.

The anticipated benefits will be presented in reports outlining the social and economic organization of transhumant households linked to the constraints on their productivity. These reports will identify specific socio-economic constraints and their interaction with biological constraints at the household and camp level.

In the process of data collection, relationships of confidence and mutual trust are built with transhumant groups by WSARP social scientists and others. This encourages the householders to participate in WSARP in-herd, on-farm interventions, benefiting project objectives. As interventions get underway (and in planning) it is important to check out their social soundness (i.e. acceptability) before diverting project resources into areas that may be culturally avoided or taboo. Also, technologies that are too

complex, labor-demanding, or radically change transhumant production practices may be resisted or evaded. Each intervention requires social science assessment through this research effort.

Better definition of the transhumant system can offer improved researcher access to transhumant groups through their social and tribal structures. Through designation of recommendation domains¹ of similar type households, technical improvements are more likely to succeed.

b. Results

(1) Introduction

The findings reported in the following sections are based on WSARP interdisciplinary field research as much as possible. Areas requiring further investigation have been noted. Secondary sources have been used to fill in data gaps, and in providing information to be verified by WSARP research.² The Results are organized to provide a step-by-step description of the transhumant system way of life, and their production system constraints and opportunities for improvement. The text incorporates WSARP goals and anticipated benefits through the Farming Systems Research approach and methodology. At this stage answers to the key hypotheses are not yet available, hence the main findings of the Results Section is a tentative description.

(2) The Cultural-Ethnographic Context

The Hawazma Tribal Confederation: One of the well-known Baggara (cattle-rearing) nomadic tribes (See Cunnison, 1966), the Hawazma traditionally occupy two ecological zones between South Kordofan and North Kordofan. In fact, the Hawazma have emerged as a "super-tribe," a

¹ "Recommendation domain" is a key technical term in the Farming Systems Approach used to classify homogeneous groupings of agricultural households occupying similar zones, who face common problems and may benefit from the extension of appropriate, on-farm tested technologies (Collinson, 1980).

² Secondary sources are cited in the text where appropriate. Where a secondary source is the only datum, the phrase is placed in quotations; it is referenced if paraphrased. Information obtained from interdisciplinary WSARP staff is cited by name in the text. The name is in parentheses, followed by "WSARP."

federation of major tribal sections and two sub-tribes in the Kordofan region, mainly in the Central and Eastern Districts of South Kordofan. The two sub-tribes are the Hawazma proper and the Halafa; the latter is located in the eastern districts and transhumes along distinct routes to eastern parts of North Kordofan near Rashad. The major tribal sections of the Hawazma occupy the Central Districts (Northern Jebels and Southern Jebels) of South Kordofan during the major part of the year, i.e., the dry season and early rains (also see Lebon, 1965).

There are five major migration routes between south and north used by segments of the Hawazma (Abdallah, 1982). They are (from West to East) as follows: (1) The Kadugli/Dilling/Abu Haraz route known as the Western Route; (2) The Talodi/Um Heitan/Habila/Kasgeil route, known as the Central Route. This route has three sub-routes composed of the Hamra/Um Dorein/Talodi sub-route; the El-Warel/Um Heitan/Talodi sub-route; and the El Hadia/Fiyu/Habila/Talodi sub-route; (3) the Kalogi route known as the Eastern Route; (4) the Liri/Benjeded/Delami-Regeba route through a shallow river valley; and (5) the L'Araish Regeba route, also through a river valley (See Abdallah, 1982).

Ten distinct tribal sections travel by one or more of these routes from South to North in the rains and back again at end of rains, with well-defined orbits for each. Some households and whole camps may change routes from time-to-time, due to extenuating circumstances of an ecological or conflict nature. In the Transhumant Panel Study, only the Western route via Kadugli has been examined thus far.¹

(3) The Western Route

The Kadugli/Dilling/Abu Haraz migration route is a major livestock trail which draws many transhumant camps from the Southern Jebels of South Kordofan. The nomads and their herds pass through Kadugli town (between mountains on both sides of the route) northward. They then follow the paved road north over mountainous terrain to Dilling and on past Debeibat at the

¹ Another route via Lagowa and Dilling followed by the Missiriya Zuruq of the Western District is also planned for study, if resources are available.

railway line where the paved road ends. From there, the route cuts across the sandy soils toward two market towns south of El Obeid, and to El Obeid itself. The southern branches of this route lead as far as Lake Abyed, to Talodi and Liri; there is a branch from the West entering from Lake Keilak, via Lagowa or Kadugli (used mainly by the Messiriya tribe).

The leading tribal sections (Dars) of the Hawazma using this route are:

Dar Jawad (sub-sections Dar Sholongo and
Dar Ny'la)
Dar Bhota
Dar Jamaiiya
Dar Rawaga (certain sub-sections)
Dar Ja'ail

This route does not cut across the clay plains areas where mechanized cultivation is widespread. As it follows the paved road, there is good access to market towns and villages as well as motorized transport along the way. There are also man-made waterpoints well distributed in the area of this route, and relatively large areas for grazing. Hence, the Western route is used heavily by traditional tribal sections and, in recent years, by other nomadic groups searching for grazing and water resources on the trek.

(4) Transhumant Seasonal Cycle:

A description of the transhumant system across the seasonal cycle starts with observation at the beginning of the dry season, i.e. the harvest period in South Kordofan in November and December. Observations and diagnosis through the beginning of the hot, dry season in March, 1983, are included here. Data is drawn from direct observation of an interdisciplinary nature, and interviews with producer households. The remainder of the seasonal findings are drawn from secondary literature and exploratory data from 1982, albeit with missing elements that may be of great importance. The critical

rainy season transhumance to the north and the cultivation period has yet to be diagnosed. The hot, dry season before the trek north is also a key time for study of this production system.

The following tables (1-6) summarize season-by-season factors in the transhumant system associated with transhumant activities and ecological conditions. Economic and social components are also noted. These tables are followed by a text for each season more descriptive of the interactions. However, with only non-observational (secondary) information available on three of the seasons (hot, dry season; early rains; late rains), this portion is incomplete. Conclusions drawn from it are necessarily preliminary and tentative.

Table 1. SEASON: Deret (Mid-October to Mid-December)

Weather & Ecological Conditions:

Very hot, getting cooler and drier.
Sunny.

Soil Types and Water Resources	Cracking clays serve as main sites for camps and for livestock grazing. Water used for livestock is drawn from surface pools and swamps. Human water from river beds and shallow wells.
Transhumant Movements	Camp groups travel south via their cultivation areas. In Nuba Mountains area, temporary camps are set up near surface water and grazing.
Livestock Management Practices	Livestock grazed daily near surface water sources on crop residues and standing hay forages. Livestock spend nights in camp.
Livestock Epidemiology	High plane of nutrition due to abundant forages. A period for high rate of conception. Livestock diseases; epidemic in goats.
Livestock Offtake and Marketing	Low rate of market sales due to movements and distance from market towns. Some small livestock sold for cash needs; women sell milk.
Cropping Activities	Harvest season. Household men and women work in fields, but only men perform threshing. Grain transported by camel to storage areas. Communal work parties (<u>nafirs</u>) used in grain harvest.
Housing Locations/ Construction	Mobile tent; sapling framework, mat covering with use of additional canvas or plastic tarps.
Human Ecology/ Health	Continuing problems with malaria, other water-borne diseases.

Table 1 (Continued)

Sociocultural Events	Camps moving south visit sedentary relatives in towns/villages enroute; re-establish relationships in South Kordofan. Tribal sections split into separate fariqs for movement south with household herds.
Consumption Patterns	Good diet based on milk products, harvested grains and field crops, and gathered wild plants. Some hunting. May purchase new household goods and clothing.
Domestic Activities	Major responsibility is housebuilding at each new site, packing and unpacking household goods. (More research needed.)
Education	Schools are open in some areas. Children live in villages or town homes with sedentary relatives, or in <u>fariqs</u> near school.
Constraints and Impacts	Livestock: Incursions on unharvested croplands along southward migration route bring heavy fines, disputes. Some range area destroyed by fires. Man-made surface water denied to livestock by sedentary farmers.

Table 2 (Continued)

Sociocultural Events	Weddings, visitation with relatives, funerals, and legal-political meetings by men at town courts. Voting time for transhumant S.S.U. cells. Attend court cases over disputes, blood-debt settlements within or between tribal sections by male household heads.
Consumption Patterns	Consume from own food stores, supplemented with vegetables (limited varieties) from market, especially dried okra. Some use of dried legumes (e.g., cowpeas). Rice, manufactured beverage syrups, etc. served at ceremonies.
Domestic Activities	Intensive labor expended in gathering wood and grass for house building. Other activities: gathering firewood, carrying water. Time spent on food preparation increases due to increased numbers of visitors, life-cycle ceremonies.
Education	Children attend school in villages and towns. Some stay in dormitories and visit fariqs on weekend. Others cared for by sedentary relatives in nearby towns with schools. Livestock sold to pay school expenses.
Constraints and Impacts	Decreasing and low quality grazing: high risk of disease in herds. Energy loss due to twice daily grazing. Burning of range grasses. Crop residues more difficult to obtain. Water points less accessible. Market prices low.

Table 3. SEASON: Seif (March through Early May)

Weather & Ecological Conditions:
 Very hot, Dry and Sunny. Low Humidity.

Soil Types and Water Resources	In Nuba Mountains area livestock graze and browse on dry grasses or remaining crop residues and last growth of swamp grasses. Watered at wells, wateryards in crowded conditions. Water very scarce.
Transhumant Movements	Livestock, especially cattle, usually leave camps and are moved to areas with remaining forage and water. Camps remain stationary with milk cows and small ruminants.
Livestock Management Practices	Cattle and small ruminants grazed overnight to avoid daytime heat. Brought to water every other day or once a day. Milk cows are grazed twice a day nearer to camps. One <u>fariq</u> member may manage herds for more than one household.
Livestock Epidemiology	Animals subject to malnutrition and significant weight loss and their condition deteriorates. Milk cows dry up and few cows are serviced; there are few calves. Weak animals succumb to disease.
Livestock Offtake and Marketing	There is little marketing of animals, except culls and small ruminants. Prices are low.
Cropping Activities	There are no cropping activities during this season. Sorghum is purchased from villagers when stocks run low, as market prices are high in towns.
Housing Locations/ Construction	Continued use of <u>jahoba</u> , <u>humar</u> house types. Women may add bath huts; expanded <u>rakubas</u> . Men build <u>rakubas</u> for receiving visitors.

Table 3 (Continued)

Human Ecology/ Health	Increase in gastrointestinal diseases related to decreasing quality of water supply, as watertable lowers. Most likely period for meningitis (usually fatal), tetanus, various skin infections.
Sociocultural Events	(To be diagnosed) Probably weddings and funerals.
Consumption Patterns	(To be diagnosed)
Domestic Activities	Getting water may require travelling longer distances on foot. Continued visitations, ceremonies require additional food preparation.
Education	Schools closed. Children stay in the camps, learn transhumant roles.
Constraints and Impacts	The main constraint is lack of forage; in areas where some forage remains, lack of water prevents use. Oilseed cake for supplementation is scarce. Veterinary care and drugs are difficult to find. Market prices are low.

Table 4. SEASON: Rashash (May, June)

Weather & Ecological Conditions:

Very hot: increasing humidity.
 Temperature declines with early rains.
 Cloudy. Windstorms.

Soil Types and Water Resources	Main livestock herd moved to non-cracking clays and footslopes for grazing. If rains stop, herds return to permanent water points near camps or wateryards.
Transhumant Movements	Main livestock herds moved by men away from camps to find grazing near surface water. Men scout areas of non-cracking clays and hills, changing places. Women move camp from cracking to non-cracking clay areas and remain there.
Livestock Management Practices	Animals graze on dry forage and newly leafed-out trees, drinking surface water <u>ad libidum</u> , or taken to pools daily. Weak animals left behind, young calves carried on camels. Salt fed regularly.
Livestock Epidemiology	Malnutrition and weakness are major causes of death. Parasitism of young and sick animals increases morbidity. Deaths during movement are frequent, especially among newer calves. Milk yields are low.
Livestock Offtake and Marketing	Few cattle are sold, except culls. Small stock are marketed when cash is needed. Prices are beginning to rise for livestock. Sick animals may be slaughtered for meat. Milk from main herd drunk by men: milk herd handled by women.
Cropping Activities	Land clearing for planting begins. Men visit their plots to assess which crops to grow, purchase seeds, if needed, and prepare agricultural tools. No jubraka are planted.
Housing Locations/ Construction	Move fariq to new site on <u>gardud</u> sands in anticipation of rains. Construct mobile tents and rakubas. May begin moving heavy furnishings back to storage with sedentary relatives.

Table 4 (Continued)

Human Ecology/ Health	Increased insect population (cited as one reason for relocating <u>fariq</u>): flies, mosquitoes.
Sociocultural Events	(To be diagnosed)
Consumption Patterns	(To be diagnosed)
Domestic Activities	Begin repairing, making new items required for trek. Men reweave <u>angorebs</u> , make camel saddle pads of straw.
Education	Schools closed. Children at camps learning transhumant roles.
Constraints and Impacts	Main constraint is lack of fresh grasses and erratic rainfall leading to difficulties in watering livestock.

Table 5. SEASON: Kharif (July and August) Early Rains

Weather & Ecological Conditions:
 Rainfall frequent. High humidity.
 Temperatures reduced. Many clouds. Less
 sunshine.

Soil Types and Water Resources	Livestock graze on varying soil types (enroute to North Kordofan): non-cracking clays, mountain slopes, cracking clays, sandy soils, onto Qoz stabilized sands. Drink water ad libidum from <u>khors</u> and pools.
Transhumant Movements	Camps pack, move baggage and household members on pack animals (camels, oxen, donkeys). Advance herd with young men, fast moving animals, goes ahead to scout for water and forage. Heavy baggage, main herd behind. Camps change every 1-3 days. Stop near cultivation.
Livestock Management Practices	Animals managed on a transhumance basis; walking in morning, then watered and grazed in afternoon and evening. Grazed for a few days in morning at route stops.
Livestock Epidemiology	Long trek stressful and energy consuming. Weaker animals fall behind and may succumb to disease. Accidents cause some animals to fall out and they are slaughtered or left to die.
Livestock Offtake and Marketing	A few animals, especially small stock, are sold enroute for cash for trip expenses and to remove weak animals from herd. Prices are rising. Slaughtered animals eaten by whole camp. No milk marketing; much milk is drunk by camp members. (More research needed)
Cropping Activities	Fields are opened and crops planted. Low labor inputs are preferred. First weeding is performed by early August. Sedentary relatives supervise laborers hired.
Housing Locations/ Construction	Temporary, mobile tents constructed at each new site along trek route.

Table 5 (Continued)

Human Ecology/ Health	Increased problems with malaria. More research needed.
Sociocultural Events	(To be diagnosed)
Consumption Patterns	(To be diagnosed)
Domestic Activities	Activities related to transhumant movement. More research needed.
Education	No schooling for transhuming children. Some school children live with sedentary relatives or in dormitories. Youths trained in skills of migration, herd control, forage finding. Adolescent girls learn to work with women on tents and baggage animals.
Constraints and Impacts	Movement limits grazing and cultivation activity. Stressful on animals and people. More research needed.

Table 6. SEASON: Kharif (Mid-August to Mid-October) Late Rains.

Weather & Ecological Conditions:
 Rainfall heavy, but dry spells possible.
 Increased humidity. Cloudy, cool.

Soil Types and Water Resources	Qoz sandy soils in North Kordofan. Open <u>rahad</u> water pools. Enroute south, a variety of soils and fresh or stored water sources are used on a temporary basis. (More research needed)
Transhumant Movements	After camping maximum of two months around market towns, camps move south following water and grazing resources. May stay over at cultivations enroute, returning to Nuba Mountains later. (More research needed)
Livestock Management Practices	(To be diagnosed)
Livestock Epidemiology	(To be diagnosed)
Livestock Offtake and Marketing	(To be diagnosed)
Cropping Activities	Final weeding performed. Crop stands protected by sedentary relatives with hired labor used as needed. Visits made to cultivations from north by transhumant men. (More research needed)
Housing Locations/ Construction	Mobile tents and tarps. (More research needed)
Human Ecology/ Health	(To be diagnosed)

Table 6 (Continued)

Sociocultural Events	(To be diagnosed)
Consumption Patterns	(To be diagnosed)
Domestic Activities	Milk sales, making milk products, e.g., clarified butter. (More research needed)
Education	No schooling of children, due to movement, unless they are left with sedentary relatives. (More research needed)
Constraints and Impacts	(To be diagnosed)

(5) Harvest Season (Deret) See Table 1

The harvest season (deret) extends from the end of October through mid-December. There is usually an initial hot month which dries crops in the fields of South Kordofan, followed by cooling during December as the cool, dry season approaches. The rains having finished and the grainfields ripened and dried, the harvest begins on a large scale. Transhumant camps have already left their locations in North Kordofan by mid-September and moved southward along their migration routes following water and grazing supplies which remain more abundant in South Kordofan's Nuba mountains area. In October and November the Kadugli route is filled with transhumant households and their herds. Enroute, transhumant camps stop temporarily near surface water and make good use of adjacent grazing to preserve forage near more permanent water sources for later in the dry season. By December (or early January) most transhumant groups have found their end-point dry season camping grounds and erected large grass thatch houses and storage units.

These dry season encampments are usually situated by shallow wells (serafs) dug along the footslopes of mountains where the watertable is near the surface, in sandy beds of seasonal rivers (khors) between the cracking clay plains and the hills, or near low-lying swampy areas where animals can depend on grazing later in the dry season. The camping group (fariq) composed of a group of close kinsmen, their wives, children, adult dependents, and herdboys tends to return to the same dry season camping locale in successive years. Although there are no longer "tribal" rights to these land and water resources, many traditional ties to areas known to have grazing and permanent water supplies draw specific camping groups back again and again to the same locale.

While migrating south, households pass through their cultivation areas. They accomplish an early harvest during November and December. Depending on the amount of residual moisture from rainfall, they may graze their herds on crop residues in their own fields and those nearby. The major goals of cultivation are to reduce household expenditures for staple grains during the dry season. Transhumants do not usually grow large plots of

foodcrops or cash crops on traditional farms. On tractorized schemes some transhumants produce cotton or sorghum for sale (they grow cotton only if the costs of production are acceptable and the market price is high enough). Men, women and children participate in various harvest and threshing activities. The harvest is bagged and removed quickly from the fields using their camels for transport to the camp.

Livestock are productive during this season. Cows are still on a relatively high plane of nutrition; there is a calf crop and good milking. Small ruminants may be traded at local markets for cash to buy household needs. Women sell excess milk and milk-products to nearby village townspeople (butter and milk).

During this season there is increased likelihood of conflicts with settled farmers over livestock trespass on as yet unharvested grainfields. Early dry season burning of rangelands by sedentary farmers makes it difficult for livestock raisers to find natural grazing; herds are moved about in search of grass and field stubble.

(6) Cool, Dry Season (Shita) See Table 2

The cool, dry season extends from late December through February. Strong northerly winds create dusty conditions in open areas and fan fires; burning denudes vegetation. Transhumant camps locate near permanent water points and grazing on the cracking clays. Livestock are trailed to grazing areas twice daily. At dawn herds are moved out until early afternoon when they are taken to water. After a rest, the herds walk to grazing again until evening. As the season proceeds, livestock must walk further and have less time for grazing. The twice daily round trips uses energy during a season when forage is insufficient to maintain their condition (Bunderson, WSARP).

Men manage the herds while boys do most of the herding labor for cattle, sheep and goats. Camels and donkeys are ridden by men, and tethered close to the camp. There are no cropping activities during this season. One of the major female roles is milking cows in the early morning and at evening. Women use the milk to make beverages and clarified butter for

household use and for sale. Women keep the proceeds of these sales, but spend money for household and personal needs. Women usually walk to markets (Michael, WSARP).

Children and ill persons are offered boiled milk which is considered a strengthening food. Men use milk often in tea to entertain guests. Stocks of grainfood are usually ample. Transhumant life includes a variety of social and cultural activities that reinforce the social fabric, such as funerals, weddings and visits. Some transhumant children go to live with their sedentary relatives to attend school near towns or large villages.

Oxen and small livestock are marketed to provide for children's school fees and consumption purchases. There is feasting during this period of time also, with animal slaughter. The price of livestock at South Kordofan major markets appears to be low, since supply exceeds demand for meat at the local level and urban demand does not draw heavily from this region's animals in the dry season.

Conflicts with sedentary farmers rise during this season. South Kordofan farmers, especially the Nuba tribes, harvest late and stack harvested crops in the fields for a time. Livestock often enter standing fields or break into harvested stores in the fields, causing losses. Free access to harvested fields, a customary "right" in South Kordofan, has diminished, in the face of farmer objections. In densely populated areas, charges for use of field stubble are made or fines may be imposed on unauthorized users. Some farmers deliberately burn farm residues to keep nomadic livestock away.

The watering of livestock now takes more time and labor effort by the men, each of whom will dig out a well on a shallow watertable area (seraf) and build his own pool, into which buckets or bags of water are raised, by hand, in time for the daily watering. As the season progresses, the watertable lowers (by the beginning of March) making the labor effort greater for men and boys. Conflicts occur with horticulturalists who plant irrigated gardens and orchards around permanent well-fields; transhumant livestock are brought to water at these traditional points and may trespass while gaining riparian access.

(7) Hot, Dry Season (Seif)¹ See Table 3

The hot, dry season (seif) lasts from March through April, and sometimes into the first part of May, preceeding the spring rains. In this season ambient temperatures reach their maximum and night-time cooling is least effective. Humidity rises from the zero point early in the season to intense humidity and cloudiness just before the onset of early rains in South Kordofan. There is acute water shortage for man and animals associated with a paucity of grazing for nomadic livestock.

Herds are trailed much further from waterpoints and encampments in search of forage, mainly dry grass and remaining swamp grasses as well as some browse. A different grazing pattern is adopted--watering every other day and night-time grazing to preserve energy expended in walking long distances (up to 15 miles from water points) for forage. This avoids intense daytime heat and exposure to solar radiation (Bunderson, WSARP). The majority of the herd may be kept away from the camp by men and boys for grazing purposes and taken to water at sources distant from the camp. But, the milk herd and some small stock are grazed within the vicinity of the camp, often herded by girls.

Milk cows (and weak animals) may be supplemented with oilseed cakes or grain (sorghum) as available to maintain milk output and reduce mortality. However, milk production sinks to its lowest point of the year as many cows are dry at this season or on a very low nutritional plane with accompanying weight and condition loss (Fadlalla, WSARP). Small ruminant milks (goat and sometimes sheep) are utilized as an additional source of food, especially for weaned infants and young children. Goats and sheep are the main source of livestock sales. Still low, but rising, prices came from town-based demand for a limited supply of meat animals during the hot, dry season.

¹ Observational research partially accomplished up to March, 1983, with interruptions due to WSARP meetings and lack of field vehicles. Also compiled from secondary sources and exploratory visits during 1982 season. Need to revisit in 1984.

The most onerous labor requirements for men and boys are herding and extraction of water from wells for livestock. Women and girls carry domestic water from nearby wells or pumps. Government wateryards, where available, are used for a lengthy period of the day by crowds of herders. Nomadic camel raisers and sedentary mixed herds compete for water access with the transhumant herds, often causing overcrowding and delays.

This is also a season when epidemic contagious disease can spread rapidly from herd to herd through contact at watering points and along congested trails (Cook, WSARP). Transhumant owners remain alert to the onset of disease in nearby herds. They seek veterinary protection for their own livestock, often to no avail, due to lack of drugs at government veterinary stations or on the market. This is a season when there is little calving, and calves have less chance of survival, due to maternal malnutrition and low milk output.

In case of raging epidemics in the vicinity, households or entire camping groups may decide to make forced treks with their herds to distant watering/grazing areas away from contaminated water points. In trying to flee diseases they cannot control, they may also spread contagious disease more widely and constrain overall livestock production (Cook, WSARP).

Social activities between transhumant camp dwellers and their sedentary relatives are prominent during this season, due to ease of travel and need to accomplish family and tribal objectives before the onset of the rainy season and migration. In this season, some transhumant men leave their camps for temporary wage labor migration to the central, irrigated or urban areas of Sudan. Others travel to Mecca on the Haj pilgrimage and seek wage labor in the Gulf oil states at this time. (This is especially true in the early 1980's when the upcoming month of Ramadan fasting period is considered ritually propitious for achievement of the pilgrimage.) Marriages, funerals and family visitation are accomplished while school-age children are in camp in this season. Men engage in tribal (section) political activity at this time and may pursue legal actions at the town courts in their vicinity. Market visits are

frequent, especially among women. Men sell culled animals, especially small stock, for cash to meet consumption needs and to prepare for the upcoming transhumance northward and the cultivation of their lands.

(8) Spring Season (Rushash)¹ See Table 4

The short spring season (rushash), consisting of the latter part of May into mid-June in South Kordofan's Southern Jebels is a time of high temperatures and humidity, and sparse rainfall accompanied by wind-storms and dust devils. There is increasing cloud cover and dustiness. Cattle are watered at permanent wellpoints often far from the transhumant camp; grazing resources in the south have reached a low point.

The first real showers create pools of water in areas of (gardud) non-cracking clay soils that have not as yet been grazed due to lack of water (Bunderson, WSARP). As soon as these areas can be scouted out on camelback, men and boys drive the bulk of their herds to these zones where there is dry forage and enough regeba (pools) to provide water for livestock and people. The herds often move tens of miles away from where women and children reside in dry season camps. Milk herds are left behind with some small livestock and a male protector for each fariq. Dry season camps are moved from cracking clay sites to gardud non-cracking soils nearby permanent water sources; this avoids muddy conditions on the former and takes advantage of reduced dustiness on the latter. Also, this move helps avoid emerging insects and pests (ticks and flies) that afflict man and livestock mainly on muddy cracking clays. Transhumants believe that they also escape from mosquitoes, snakes and scorpions in this way.

Livestock milk yields remain at a low point. If the rains do not come in a timely manner, the larger herds may return to watering points at the base camp to await the onset of the full rainy season, despite loss of nutritious forages. There is little livestock marketing, but there may be increased cow and calf mortality during this period of initial herd movement.

¹ Observation of field conditions not yet accomplished; to be done during the 1983 season. Sources include secondary literature and brief exploratory visits in 1982.

(9) Early Rains (Kharif)¹ See Table 5

The mid-June through to early August period is the first part of the rainy season, and the main planting season in South Kordofan. Showers are more frequent and heavier with high humidity and cloud cover, lower ambient temperatures and reduced dustiness. As the grasses grow, the household herds are moved northward. Planting and first weeding of transhumant farms takes place.

Seasonal agricultural labor demands are high. Men engage in land-clearing and land preparation; sowing and weeding is a shared activity between men and women. In many cases, hired laborers perform agronomic tasks. Nafirs (communal labor parties) may be called to clean, sow and weed fields. Workers from associated households share in peak efforts on one another's crops.

The camping groups make the northward trek with their livestock. Much of each household's heavier belongings is taken to sedentary communities where relatives have homes, and put into storage for the entire rainy season. Often a transhumant man maintains a sedentary household in one of these communities, headed by a woman (e.g. a wife, mother or sister).

By moving north, away from the cracking clays of South Kordofan, livestock avoid the heavy mud and escape the expected onslaught of massive fly, mosquito and other insect pests. However, during the trek, weak animals may die or be left behind. This is a peak season for calving. Small or weak calves may be carried on camel back by the men. Women carry babies and young children on riding oxen or camels. From each farig (camping group), an advance herding unit (azzaba) leads the migration to scout out camping stations along the route. The main herd and baggage train moves more slowly (tegiliya), and catches up once a new campsite has been set up. Women then erect tents and

¹ Field research on this season has not yet been done. Out-of-season panel interviews provide source of partial information, which should be interpreted cautiously until observations can be made in 1983.

cooking areas and the fariq stays overnight or a few days depending on water and grazing conditions. This cumbersome procession may take 25-40 days to reach its northern most point.

Once in the sandy soils (Qoz) of North Kordofan or northern South Kordofan during poor rains, camping groups spread out on the Qoz soils near standing pools of water. Herders seek fresh grazing areas of nutritious legumes and grasses. Transhumant camps usually occupy an arc of territory south of El Obeid and north of the east-west railway line. Hawazma usually stay near their traditional market towns of Abu Haraz and Kasgeil during no more than two months of the rainy season.

The major livestock marketing activity of the year occurs here according to reports. Livestock prices are highest early in the rainy season, but the dimensions of these sales remain unknown. Women market quantities of fresh cow milk to mobile cheese factories in the rangelands or in small towns, once their cows have improved in condition and give more milk. The gathering of many transhumants in a small area of North Kordofan brings together large numbers of Hawazma for tribal activities, as yet unobserved.

(10) Late Rains (Kharif)¹ See Table 6

From mid-August through October is the second half of the rainy season. There may be a dry spell or the rains may end early in North Kordofan. The transhumants camp on the sandy soils of the north, occasionally changing location to seek more water or new grazing. Due to concentrations of many nomadic livestock there is overgrazing of the range. Increased risk of livestock disease transmission comes from the large numbers of animals mixing from different areas. Some transhumants may move away from certain localities to avoid threat of disease.

¹ No observations have as yet been made on transhumant activities in North Kordofan. Description given here is from out-of-season interviews, and needs to be confirmed through field diagnosis in 1983. In 1982, poor rains limited nomadic use of these ranges, due to lack of forage and water.

There is no cropping component to the time spent in northern areas. However, transhumant men travel to their cultivation zones in South Kordofan from time to time to inspect growing crops under supervision by their sedentary relatives.

Livestock are grazed on the sandy soil vegetation of North Kordofan where insect populations are considered to be less troublesome and insect-borne cattle disease declines. However, livestock are "smoked" at night to keep away flies. Although transhumants claim the plants eaten by livestock in North Kordofan are salty, they also feed salt and Natron to maintain livestock condition. No supplemental feed is given (some of this information from Bunderson, WSARP).

This is probably a period when many livestock sales take place in the market-towns near El Obeid and in El Obeid market. As the season progresses, prices for meat animals decline, due to increasing supply. Urban (Omdurman) merchants and overseas export market demand are major sources of price fluctuation. Cheese factories buy large quantities of milk from Hawazma women at low prices during this season (Reeves, 1983).

This is a time when cash is available for increased consumption. Transhumants may purchase millet, a North Kordofan preferred grain staple, in place of their sorghum supplies from South Kordofan. Some market-bought vegetables may be consumed, but none are grown in the camps. Transhumants may be obliged to purchase charcoal as there is less wood for fires in the sandy north.

Transhumant groups spend, at most, two months in North Kordofan during the rainy season. Over the generations they appear to have experienced migration drift toward South Kordofan as increasing desertification and cultivation in the north ruined their rangelands. Some transhumants still maintain an ancestral Dar (homeland) in the Qoz areas. (Personal communication from University of Khartoum Professor D. Samani, confirms informant claims.)

By the end of September, they begin their trek southward again. Their route is the reverse of the earlier northward trek. They stop near their cultivations and sedentary kin enroute. As the water pools dry up in the north earlier, phalanxes of camping groups travel in processions along the western route. The main Hawazma tribal sections go over the mountains to Kadugli, then fan out into the clay plains. They camp, at first, near temporary water sources and good grazing. Later they settle into camps near permanent water points for the long dry season ahead. The cycle is once again complete.

(11) Initial Identification of Transhumant Constraints to Production of Social and Economic Importance

According to available literature, observation and interview, there are three main types of constraints on access to range and water resources for transhumant producers located along the routes. Geographically, there are two poles--the dry season (South Kordofan) and the wet season (North Kordofan), each with its own special problems. The trek itself is a third source of constraints, involving the movement corridor and the camping stations along the way.

During the early part of the dry season (November-December) transhumants are faced with fines by local cultivators and mechanized scheme operators for trespass of livestock on crops not yet harvested. These fines are often very high, due to control of assessments by local Agricultural Committees supported by the courts. In addition to paying fines, transhumants must spend time and management effort locating their seized livestock at the town or village corrals where they are held without access to forage until the fine is paid, and in trailing the animals back to their pasture and watering areas.

Causes of increased trespassing are the increasing size and dispersion of mechanized farming schemes across traditional grazing areas, and the widening of traditional cultivation by settled farmers over the past two decades, with consequent shrinking of grazing areas. Former gifar

(traditional communal grazing lands) on the cracking clays have been taken over by cultivators since the beginning of the 1970's when the customary barriers to this exploitation were removed (Abdallah, 1982; Lebon, 1965).

After the harvests, from January to March (the cool, dry season), transhumants have traditionally grazed livestock on the standing crop residues of sorghum stalks and cowpeas. But, changes in farmer perceptions of this practice have led to banning entrance to farm plots, burning of crop residues and/or sale of stalks as dry fodder. In some areas, fines are being sought for trespassing by livestock in crop residues. This is a radical change from traditional free access to field stubble, seriously restricting available grazing for transhumant cattle. Fariqs locate near towns to send their children to schools and to sell milk products to townsmen. Often they find watering areas, especially hafirs, closed off to their livestock. Some surface well areas have been surrounded with horticultural plantations, thus denying riparian rights for livestock.

Near settled villages and towns (and on mountainsides) range burning occurs early in the dry season, preventing transhumants and sedentary herders from using the standing natural grasses. Later in the dry season, swamp grasses and trees are burned, also. These fires appear to be deliberately or accidentally set, mainly by rural settled populations for a variety of reasons. Some range is burned by camel nomads to stimulate regrowth of leafy vegetation and open the way for camel movements through the tree canopy. In the dry season, camel nomads also cut trees for firewood to sell to town households. Charcoal makers cut trees year-round to make fuel for townspeople, decreasing long-term range productivity. The environmental losses from these destructive practices include: (1) Replacement of perennial grasses with fire-resistant annuals; (2) Invasion of fire-tolerant bush in place of forests which decreases browse; and (3) Soil erosion. The result is decreased availability of dry season forage for livestock, lowering their nutritional status, and a decline of soil fertility (See Bunderson, 1981).

(12) Baggara (Hawazma) Human Ecology, Social-Economic Organization, and Values

Units of Production and Consumption:

Transhumant Hawazma social and economic organization is based on a mutual self-help system between households within one fariq or camp. Each transhumant camp also maintains a network of relationships with other camps and with sedentary villagers, primarily relatives. Members place a high value on these close kinship and friendship links. Utilizing both natural and human resources, transhumants attempt to optimize use of land, water, animals, crops and labor.

Production and consumption units are not coterminous. Our social science diagnostic study shows that the minimal social and economic unit of consumption is the nuclear family, i.e., residents of one tent (beit). The nuclear family household consists of a mother and her immature children, or a sister providing a home for her siblings who are not yet married. It includes a husband or adult brother or married son who is the "provider" for the unit. In this Islamic culture where a man may take up to four wives or where a widowed or divorced woman must be in the care of an adult male, the role of provider for more than one tent may be vested in one individual. The provider supplies food and controls the sales of most agricultural products which generate income. Cash is used to purchase goods and services, including household furnishings and utensils, clothing, education, health care and personal needs. Livestock purchases are major responsibilities of each male provider.

The key production unit is the expanded family or compound cluster of households, supervised by an adult male, composed of female-managed sub-units. This man, who may be provider and major purse-holder for more than one tent, manages the combined herd of his compound household. Likewise, the provider manages the cultivation of rain-fed crops with the

assistance of his women and children and occasional use of hired labor. Food crops are consumed from a common food store by the compound household membership.

Within a camp, these are the basic consumption and production units. Actual patterns of production and consumption go beyond the level of the basic units. A group of men may decide to entrust the everyday management of their herds to one man. This may happen, for example, when the fariq is in its dry season location. If water becomes scarce, or an epidemic disease threatens the herd (as happened to one "panel" fariq this year), the main household herds may be led away by one man as a composite herd to another area some distance from the fariq. Other production-related decisions may be more spontaneous, as in the case when a camel ate a noxious plant and was on the point of death. Most of the men of the fariq were away at a funeral for several days. An older, respected man who was present made the decision to slaughter the animal; he made the contact with some sedentary Nuba men who purchased the carcass and butchered the meat; and he collected the payment on behalf of the owner.

Women also vary the pattern which allocates productive or production-related labor to a nuclear or compound household unit. A woman may take on the task of milking for another woman who is away. Also, should a woman need to make an all-day excursion to gather wood or cut grass for housebuilding, she will leave her younger children in the care of another woman. Another example of mutual support has been observed on several occasions. A woman with regular milk customers may borrow one or two measures of milk from another woman when her cows fail to produce the expected amounts, to be repaid when there is a greater yield (Michael, WSARP).

Consumption patterns also vary. For example, men do not typically eat their meals in their own house, but usually share a common meal with other men present under the men's tree or rakuba (shelter). Provision of the food for these shared meals rotates among the various households, or several households may each contribute a smaller amount of food for a given meal. When male visitors are in the fariq, hospitality requires that each household proffer food, tea and/or coffee. This sometimes results in the number

of portions offered exceeding the number of guests. Women typically share meals with their married daughters, with their mothers, or simply in congenial groups. Any child present when a meal is served, whether or not a resident of the tent, will also be fed. Meals are shared, even in token fashion, as no one likes to eat alone. Transhumant values require that food, water and tea (though not many other consumable items) be redistributed to create a more or less equitable access to basic needs by all members of a camping group.

(13) House Construction and Use¹

Housing for the nuclear family unit varies by use, and therefore by season. There are three types of tents, each built for a different purpose. Tents used on the transhumant trek are easily dismantled. In the dry season camps, where Hawazma spend up to nine months, larger, more elaborate structures are built. However, locally gathered fibrous construction materials are essentially the same. The three tent types are: (1) the portable trek tent (beit Murhal); (2) the jahoba; and (3) the humar, (i.e., "donkey"). The first type is used during transhumance and the beginning of the dry season, while the latter two types are dry season structures. The framework for each of the three types is made of saplings and some larger poles set into the ground in a circular or oval pattern. The saplings are bent to form a dome-shaped roof. Flexible branches and sorghum stalks are tied horizontally onto the uprights with bark strips or rope. The external covering of the framework is either mats (if the tent is mobile), and/or grass thatch (if the tent is stationary). Internally, the walls and ceiling of the structure are covered with mats, often of brightly colored strips and geometric designs worked into those mats that run horizontally around the walls. A low, rectangular doorway, usually framed by a specially door-shaped mat, is left open on one side or at the end. Both the mat and thatch coverings allow good air circulation as well as filtered sunlight into the interior space.

The differences in the three tent types are of scale and portability. The portable trek tent is circular with a floor diameter of eight to ten feet and a maximum height of about eight feet. Mats are used as

¹ This segment was written primarily by the Associate-in-Research, Barbara Michael

the external covering, along with plastic or canvas tarps to increase rain-shed. Most of the framework is reuseable. The jahoba is also circular, but with a larger floor diameter of twelve to fourteen feet, and a center height of eight to ten feet. The humar, or long house, has an oval shape with a rounded top. It may be twenty feet long and twelve to fourteen feet wide. The center height is eight to ten feet, but descends at either end. The door of the humar is at the higher end. The humar is used both for housing and storage, due to its longer interior space.

Another structure which is an essential part of the living unit is the rakuba, a three-sided, rectangular thatched hut used as a kitchen, and/or as a temporary bedroom during transhumance. Much of the daily household activity and visiting takes place in the rakuba, which may also be used for additional sleeping space for adolescent boys or men. The rakuba is usually supported by a framework of heavier poles and at one corner by a living tree. Rakubas also incorporate sorghum stalks, either as uprights between the poles or as horizontals. Some women also build a small, rectangular, thatch bath hut to one side of the tent.

Basic household furnishing appear spartan. Several of the items are considered so essential by transhumants that they take on symbolic importance, reflecting the values of transhumant living. One of these is the angoraib, a laced rope or thong bed and seat, supported by wooden post legs. Another is the tea set; teapot, tea glasses and serving tray. Both of these are necessary, not only for everyday living, but also embody the Hawazma value of hospitality. A visitor to a fariq will immediately be invited to sit on an angoraib and it will be moved into the best shade. As soon as possible, tea will be served. The third item, considered essential for transhumant life, reflects the importance of cows and milk. This is the bouksa, made from a gourd with a basketry neck and lid, and criss-crossed with a cowhide thong strap. It is used as a butter churn or a storage container for fresh or soured milk. Every woman owns at least one bouksa and usually two or three of different sizes.

Other household items include various food preparation and serving utensils such as mortars and pestles, metal (and sometimes clay) cooking pots, wooden and enamelled tin serving bowls, wooden

stirrers, etc. Also, a tin coffee pot, server and tiny ceramic cups, a metal charcoal brazier; a heavy metal sheet for cooking kisra (a thin, unleavened sorghum bread); low four-legged stools; (bambara); water carrying and storage containers; and various mats. Another typical transhumant Baggara bed, the diringl, is made of split cane strips interwoven with leather thongs and supported on wooden tripods at each corner. The diringl is dismantled and rolled up for trekking. Storage is typically on a manger-like sling made of pole legs and tied grass bundles. Other furnishings include traditional leather items such as bags and braided leather holders for gourd, glass, or tin containers, often used as decor.

During the dry season, these minimal furnishings are supplemented by less portable items, stored for half the year with sedentary relations. Once the transhumant households set up their more stationary dry season houses, they bring iron beds with cotton mattresses, wooden tables and clothes horses, different sizes and additional numbers of cooking pots, serving bowls and trays, drinking glasses, tea glasses and coffee cups to the fariq. These household goods and family memorabilia are used from about January through June, when they are again placed in storage before the northern trek.

The obligatory mobility of a Hawazma household during transhumance belies the variety of furnishing, clothing, and personal effects which may be available and used for the rest of the year. Wealth, standard of living, as well as the modernity of a particular household are reflected in the variety, amount, and value of these goods.

(14) Physical Arrangement of the Fariq

A fariq is more than a group of tents. Its arrangement reflects Hawazma values and social organization. The general shape of a fariq is circular, an egalitarian form in which there is no beginning or end; no visibly higher or lower position. A sheikh (camp leader) does not have a privileged place for his tent; it is simply one of those within the circle, and his tent may not even be the largest one in the camp. The doors of the tents face inward toward the center of the circle. The focal point of the fariq is the shajara (shade tree), usually at the centerpoint known as the surra

(navel) of the camp. Here the men meet and receive male visitors. The circular shape and the inward-facing tents also symbolize the solidarity of the group whose members are tied to each other by multiplex links of descent and marriage or friendship. A fariq may include members who become attached to it in a number of ways. These "outsiders" are incorporated into the circle, hence into the social order.

The area of a fariq may be seen as a series of concentric circles. Within the arc of the housing ring allocated to a compound household, the tents of the senior male providers are arranged with the tent of the last-married wife on the far left. Other female dependents usually have their tents on the far right. Inside the ring of tents are small zaribas, or corrals, constructed of thornbush and also circular in shape. Each compound household has its own zaribas for calves, small ruminants and donkeys. The innermost circle is the dry season site of the shajara (tree). Men spend a great deal of their daylight hours at the tree, talking and taking their meals, or early morning tea and milk, while sitting in circles on angoraiba or mats. There may be a small rakuba built at the tree for their use. Sometimes a special larger rakuba may be built just outside the outer ring of tents. It is built for mourning or a place for meetings. Both the shajara and these rakubas are clearly defined as male space, especially when there are visitors to the fariq.

Women carry out most of their activities within the space defined by the tents and their contiguous "courtyards," an area of swept, hard-packed earth. The only other structure constructed outside the right of tents is the oval wedding house, a temporary tent for a newlywed couple, placed just behind the tent of the bride's mother. Thus, the fariq is more than a physical arrangement of tents and households. It is also a symbolic arrangement in which household groups are joined in solidarity, facing toward the center of the circle of their lives. Ceremonial structures for funerals, weddings and gatherings are located right outside the daily circle of tents.

(15) Cattle and Human Values

Household members in a transhumant fariq live within yards of their main capital asset and source of livelihood, the cattle and small ruminant herds and flocks which they own and manage. Cows, sheep and goats wander into the tents at times. There is a symbiotic relationship between these domesticated ruminants and their human managers which is biological and economic, and by analogy extends to social-cultural values concerning cattle.

The culturally approved kinship system of the Hawazma is adapted to maintenance of their valued livestock herds. Hawazma are expected to marry in (and reproduce within) the group; marriage is forbidden within tabcoed Koranic limits of incest that absolutely eliminate sexual relations between kin closer than first cousins. No siblings, or parents, or immediate aunts, uncles, nephews or nieces may marry one another.¹ A man may not marry his father's former wife. At the same time there is a decided preference for close cousins, and an avoidance of marriage beyond the wider kinship group of the tribal section; also, there is resistance to marriage with persons of other Sudanese tribes, especially with non-Arabic speakers. Hawazma observe a customary ban on marriage to non-Muslims, even though the Koran allows Muslim men to marry Christian or Jewish women. In Islam, men may marry up to four wives, but most Hawazma men remain married to only two or three wives at a time.

Marriage to a female close cousin is preferred for a variety of reasons. It is thought to be good because the spouses know one another since childhood and may have grown up in the fariq together. This shared background is thought to make the marriage endure, keep the wife obedient to her husband and he responsive to her needs. Also, it becomes an alliance between the households of each spouse, which increases their solidarity and common interest in the offspring. This helps to prevent divorce and to heal any interpersonal ruptures through parental and sibling pressure for reconciliation. Should a woman be widowed or divorced young, she can marry a man outside her

¹ Persons wet-nursed by the same woman, also, may not marry one another, according to Islamic rules.

group rather than be obliged to marry another close cousin. But, a first marriage is controlled by her parents, especially her father and/or mother. At times, marriage to a close cousin serves the economic function of retaining heritable property within the kingroup over generations.

(16) Gender, Role and Labor Allocation¹

Among the transhumant Hawazma, roles are assigned according to sex and age. Some activities are normatively male or female, but the lines drawn between men's spheres and women's spheres are more or less flexible, depending on context. WSARP observations show that (contrary to statements in the literature, Cunnison, 1967, Rogers, 1980) women's roles are not hemmed in to the point of subjugation. As in most cultures, some roles and activities are primarily female; some primarily male, while others are allocated to children. Some activities are joint, male/female, or are interchangeable.

Major production activities such as cattle husbandry and livestock management, as well as cultivation work are primarily male activities. Owners decide to add to, or cull herds, but men control when and where to move for grazing. Herd movement decisions by men may also involve a decision to move the entire fariq. In herding cattle, men, their sons and hired herdboys supply the labor. Men decide where to cultivate and what crops to plant. The full extent of women's labor input in cultivation is not yet known; however, it is the men who lead the harvesting. Men also hire labor for herding or cultivation.

Women (as well as boys and sometimes men) milk cows and goats, and sometimes sheep also. Women decide how much of the milk produced to keep for household consumption and how much to sell. When it is plentiful, they allocate some for butter making, either for their own use or for sale.

¹ This section was written by the Senior Social Scientist and the Associate-in-Research based on shared field observations.

Men, in their role as providers, are the major purseholders; selling animals or perhaps grain to provide the necessary cash for expenditures on food, clothing, household goods or education. Women control the money they earn from milk and milk product sales. They may also have cash income from the sale of chickens and eggs, or at times even goats or sheep. Women voluntarily spend their cash to support the household or to provide "extras" for themselves or their children. Women buy quantities of sugar, tea and coffee, as do men. A woman may purchase an iron bed or trousseau items for a daughter soon to be married.

Children also participate in production activities. Sons from about the age of twelve years help with cattle herding. Younger children, of both sexes, herd goats and sheep. Adolescent girls (and some women) make milk deliveries to customers in sedentary villages near the fariq, or to town markets.

Women are primarily responsible for housing and domestic activities. They construct houses, cutting and gathering the necessary wood and grass for thatching. They also transport most of the materials on foot. Men may assist with animal transport of construction materials. Women gather firewood and carry water; if they have daughters, water carrying is delegated to them. Women and their daughters share in food preparation and the making of tea or coffee, both for their own households and for the men and their visitors at the men's tree. Children, both girls and boys, assist by carrying food or tea to the men and help women clean these utensils. Women have primary responsibility for child rearing; feeding, bathing, supervision, and health care. However, men also participate; instructing, disciplining, and demonstrating affection. Actually, any adult in the fariq may participate to some degree in a child's rearing, disciplining, feeding and comforting, if the child is within "range," or if his mother is away from the fariq. Older siblings also help with child care.

Another major male role activity involves laws and politics. Men are largely responsible for negotiations between groups. They negotiate in cases of blood-debt payment or the settlement of disputes with

sedentary farmers over the intrusion of cattle into cultivations. They make 'amana (entrustment) agreements, whereby they herd animals for their sedentary relatives or provide milk cows to them. Men may borrow land for cultivation from sedentary friends. Women also share in maintaining a variety of social networks, but men deal with the officials or tribal "outsider" categories; such as men from other fariqs, traders, government agents and authorities.

Women may influence politics, often in a quite public way. For example, it is widely known that young women in a fariq compose and sing songs about events such as intergroup violence or a man's reputation for generosity, thus interpreting prestige and inciting men to acts of bravery or risk-taking. Older women compose praise songs about their men's standing, or sanction norm-breakers with critical verses (See Carlisle, 1973 and Cunnison, 1963).

Both men and women share in a number of other roles and activities. They both make household food purchases; women for the minimal unit, men also buy for the extended household groups. Men and women participate actively and intermingle in ceremonies and festivities involving kin relations, such as weddings and funerals where some gender barriers are overlooked situationally. Men or women may purchase and manage supplementary feeding for specific animals such as milk cows, sick cows or donkeys. Our observations are that some women allocate a portion of their income from milk sales to supplementary feed purchases. Both men and women travel extensively and frequently to visit relatives as well as to social services such as health care facilities (clinics, nursing stations, hospitals, pharmacies) or traditional medical practitioners.

When travelling, women are nearly autonomous. Women regularly go to market without menfolk along, take their children to a health clinic, or go off for several days to visit relatives. They may travel long distances alone by lorry. Observations indicate that though men's and women's activities may be separated spatially, women are not unduly confined in their roles or decision-making, compared to other Islamic societies.

(17) Socio-demography of Transhumant Hawazma Households and Camps

Among the Hawazma tribes of central South Kordofan it is infrequent to find a camp composed of less than five or more than ten married men and their wives, children and dependents.¹ Although a Muslim man is allowed to marry up to four wives, none of the Hawazma interviewed had more than three co-wives. Only well-to-do men (with over 100 head of cattle) who are over 45 years of age had three wives. Younger men had only one or two wives. The majority of those with two wives were over thirty years of age. The modal frequency of wives per man was also two. Older or poorer men frequently maintain only one wife, although they may have had more in the past.

Several widowed or divorced women live in fariqs of their male kin or affines. A woman need not remarry if she is older and has growing sons. A young widow usually remarries (after a year-long customary waiting period), often to a kinsman in the fariq of her deceased husband. A young divorcee returns immediately to the fariq of her natal kin and can remarry elsewhere, after three months wait. However, marriage ties form the critical glue binding together households within a fariq and maintaining the transhumant way of life. Divorce is not frequent, compared to other Baggara transhumant societies such as the Humr (See Cunnison, 1966).

The observed median number of surviving children under age fifteen in a minimal household unit is five per reproductive (completed) woman. The typical size of a fariq including children, men, wives and other adult dependents varies from about fifty persons in a small camp to over one hundred in a larger one. The majority consists of children under age fifteen, who constitute 50-55 percent of the population on the average. Another 15 percent consists of adolescent and unmarried youth up to age 19 for girls, and age 25 for boys.² The remaining third of the fariq population usually

¹ Information based on data from four transhumant camps and brief counts of several others.

² The average marriage age for females is several years less than that for males, as the latter must accumulate a herd with which to set up a household, Nuba herdboys add to the male numbers of adolescent youth, while out-marriage reduces the frequency of female adolescents.

divides into a ratio of 2:1 adult women over 19 to adult men over 25 years of age. About 5-10 percent of the members are able-bodied married men who manage the households, herds and cultivations. Approximately 5 percent of the population is over 60 years. Elder men are usually cast in the role of advisors to the sheikh (camp leader).

The sheikh is usually a respected man between the age of 40 and 60 years who is elected by the male household heads. His job is mainly that of coordinator, host and spokesman for the fariq group to outsiders and government officials. He also serves as an official livestock tax collector for his camp. The sheikh's tent looks no different than that of his peers, but a sheikh should have enough livestock wealth to entertain visitors generously and to contribute to tribal activities. If a sheikh does not perform to the satisfaction of his group, he is replaced by election. Any adult male member of the fariq may be politically active in the transhumant branch of the Sudanese Socialist Party, in local council activities or in tribal politics. In tribal matters, ability in speech-making and generosity with food and livestock counts for more than official position in most cases.

In general, it is considered morally good (and safer) for closely related households to transhume together, to share many responsibilities for livestock maintenance, to share in consumption of food and beverages, and to spread the costs of hospitality across several households. Also, the costs of production are shared by use of common facilities, such as a syringe for vaccinations of livestock (usually possessed by the sheikh) or of other veterinary medication.

In addition to the help of their adolescent sons, a compound household will usually have one or two hired herdboys for cattle, depending on the size of the herd. The herdboy is usually a Nuba youth who is paid one young cow per year, plus board. Men from each household cooperate in the allocation of herding labor while on transhumance or distant grazing by combining their herds or caring for one another's herd during absence or illness.

In short, the fariq is an important unit of cooperation in livestock production. A camp achieves economies of scale and provides a support system and form of labor insurance for its membership. Fariq members protect one another in case of danger from man or beast; they assist one another in adversity as well as celebrate successes and important events together. Their reciprocity is an essential element in the organization of the transhumant movements by season.

The ties of solidarity which bind fariq households together are usually based on close patrilineal and cognatic kinship ties, i.e. arrays of brothers and their fathers make up the structural units of a camp, which are genealogically defined. However, as the number of married men and households expands and the camp herds grow too large to support the grazing needs of all within a reasonable radius (usually when the number of married men exceeds ten), there is a tendency toward fission into two or three smaller fariqs. The hived-off clusters form their own circle of tents, apart; often they are semi-detached from the parent camp for some time. The new groups are usually composed of a father and his married sons, or a married set of siblings and their paternal uncle or nephew.

Once split, the smaller fariqs begin the growth cycle once again. Sometimes, portions of a fariq will split off as household units or pairs of households to join another fariq due to internal conflict or preference. Fariqs may include some outsiders, and change in membership over time is common. But, the core members of a fariq will often transhume together for many years (see also Cunnison, 1966). Case studies can illustrate these social and economic processes as follows:

(a) Case Study I: Summary - Fariq of Sheikh Juma
Bashir Malik

This camp is composed of mainstream¹ Hawazma transhumants who spend 5-6 months during the dry season on the Seraf El-Ahmar.

¹ Mainstream is a recommendation domain in Farming Systems terminology.

In the beginning of the rainy season, they travel north along the Kadugli-Dilling (Western) migration route to Abu-Haraz near El Obeid. This fariq is a member of a major descent group, Dar Shalongo, in the larger tribal section, Dar Jawad. The fariq is the southernmost representative of its descent group, with other Shalongo fariqs, numbering about a dozen in all, located between Kadugli and Dilling during the dry season. Over half this descent group is now settled in village communities north of Dilling.

The fariq is composed of two patrilineal groups of close kinsmen linked by a common ancestor five generations ago. There are five male household heads at present. The modal number of wives per man is two, the sheikh having three wives. Three men care for a widowed mother. Two provide for a widowed sister-in-law and her children, managing herds for the heirs of their deceased brothers.

The median number of children per minimal household (tent) is five and children under 15 years of age make up 55 percent of the fariq population of about 80 souls. Three of the adult men are middle-aged, one is an old man, and one is under 30.

Over half the total number of adult women married their first patrilineal parallel or cross-cousins, i.e. first degree marriages. Another one-third of the women married second or third degree cousins. Only two women come from unrelated groups, one from outside the tribal section, but none from another tribe.

This multiplex group has a characteristic age-sex structure for transhumants. The interactions between herd management and control on the one hand, and the marital relationships and demographics of a fariq and its constituent households on the other, will be the subject of further research.

(b) Case Study II: Summary - Fariq Haj
Younis/Hamid Hanai

This fariq camps on the Seraf El-Ahmar for up to eight months in the dry season. Two households are of sedentary tendency; the camp contains some regular transhumant households and one nomadizing household. There are nine male heads of household in this camp. Transhumance currently follows the Kadugli-Dilling (Western) migration route to Kasgeil, near El Obeid, although in the past, a longer route (the Central Route), was taken. Most of this fariq is part of the Ouled Nuba¹ tribal section, but it contains one Dar Sholongo household as well as a Nuba household. Some members remain in South Kordofan during the rainy season, staying in a nearby village where a dozen settled households of their lineage groups live also.

The fariq is an amalgam of men from different minimal lineages related mainly through marriage to a set of siblings in the previous generation, i.e. through matrilineal kinship and through affinal ties to one another. There is no single patrilineal ancestor for all these household heads. The marriage pattern resembles that of settled Hawazma with fewer number of wives per man (the median is one wife), as only two men have a pair of wives each. One wife lives in a village, the other in the fariq in each case. Widowed women related to these men also live in sedentary communities. Only the sheikh's widowed elder sister transhumes with the fariq; she manages her own household with the help of her grown son.

Of the 54 members of this fariq, over half are children. Ten percent are over 60 years of age. Only two men are in the mature male age of 40-60. There is no strong tendency to marry one type of cousin; two men in the fariq had no kinship link to the others, only friendship. Although partially transhumant, it appears that some households of this fariq are sedentarizing; one is nomadizing. Also, some women in the fariq are more attuned to a settled life. They are less dominated by the menfolk than in a mainstream transhumant camp, such as Case I, above.

¹ Ouled Nuba does not refer to sedentary Nuba tribes, but to a major lineage of Hawazma inhabitants of the Nuba Mountain area.

(18) Transfer of Livestock

In addition to market sales, offtake through consumption and loss of animals through death or theft, cattle (and small ruminants) are passed on to persons outside the transhumant household mainly by means of inheritance, gift or blood-payment. These transfers include reproductive animals, while livestock sent to market are mainly male castrates and sterile cows.

Cows may also leave the herd by departure of a hired herdboys (usually a Nuba), who accumulates young cows at a rate of one head per year of service, plus natural increase. Many herdboys keep their livestock with the Hawazma fariq for lengthy periods, maintaining the breeding relationship. Once married, a grown herdboys will leave the fariq to join his Nuba kin, or he may continue to transhume with the Hawazma fariq in which he "grew up."

It is a cultural imperative among Hawazma nomads that their children drink milk regularly; milk is highly valued for adult consumption as well as sale. Fariq dwellers entrust ('amana) milk cows to their poorer sedentary relations for this purpose. The cow is returned to the herd when dry and replaced by a fresh cow. New calves belong to the transhumant owner. Similarly, sedentary kin confide their livestock to transhumants to be trekked north during the rainy season. Cattle or sheep and their offspring remain the property of the owner, but the transhumants have rights to the milk.

Most inheritance of livestock passes from parents to children, mainly from father to son. A sedentary brother may inherit cattle from his deceased transhumant father's herd, and then confide the animals to his nomadic brother in the fariq. These practices maintain the breeding herd as a whole. Most cows come into estrus during and just after the rainy season and are usually serviced by bulls from the transhumant herd. In short, inbreeding of cattle is very frequent in a transhumant herd for several reasons.

Inheritance of livestock, especially cattle, is intimately linked to traditional forms of preferred marriage and the special status of women in the transhumant camp. According to Islamic law (which Hawazma claim they follow), a parent's patrimony is divided at death among the offspring in a ratio of two parts for each son to one part per daughter; the surviving spouse also inherits a portion. In this way property is split among several heritors. This could fractionate the herd and disperse it among several households, some outside the camp.

However, by Hawazma custom, nomad women "voluntarily" return their cattle shares to their male siblings in the fariq. In some cases they entrust the cattle, in others they do not claim their share from their brothers. This effectively prevents a splitting up of the parental herd.

Immature sons have their herd shares held in trust by an older married brother or paternal uncle (or even by a widowed mother and her male guardian) until they marry. As each son marries, he claims his share until the entire herd has been passed on. Hence, most herds are not divided immediately upon death of a father, except among married sons.

As shown above, the majority of marriages in a transhumant fariq are between close cousins, often between households in the same fariq. This practice assures stability and continuity in the total herd composition of the camp and its households through inheritance procedures. Few reproductive cattle are transferred permanently to outsiders.¹ The socio-economic functions of close cousin marriage involve retention of property within the group, control over the labor of kinswomen, and economic and political solidarity among the constituent households in a camp linked by marital affinity and multiplex kinship bonds.

¹ These devices maintaining a breeding herd within a transhumant camp over time. This suggests that interventions to improve genetic production characteristics through use of stud bulls and improved young cows may successfully raise hybrid vigor as they spread through a transhumant herd that is a relatively inbred isolate (Personal communication from Dr. Babo Fadlalla, WSARP).

(19) Agro-Pastoral Linkages Between the Transhumant and Sedentary Systems of South Kordofan

Field visits by scientists of WSARP, Kadugli have confirmed the findings of secondary sources (Hunting, 1980) that transhumant nomadic camps spend long periods of time in the Nuba Mountain area of South Kordofan from November through June. Also, this so-called "wandering" population enjoys strong ties to permanently settled groups in the region. The majority of the transhumant population consists of Baggara Muslim Arabic-speakers, mainly of the Hawazma tribal federation described above. Over half the Hawazma are no longer nomadic, having settled out over the past two to three generations as sedentary farmers, or government workers and traders in towns and villages.

Evidence of the sedentary-nomadic ratio comes from a WSARP genealogical field census of the minimal lineages in one major lineage named Dar Sholongo, whose membership resides along the Western migration route (Kadugli/Dilling route to Abu Haraz) in South Kordofan. Of 24 clusters of minimal lineages recorded, 11 are engaged in transhumance, while 13 were mainly settled farmers (some were townsmen). Eight of the 11 transhumant groups contained a sedentary household unit which cultivated, while the majority of fariq members travelled with the livestock during the rainy season. Only 3 of these minimal lineage groups were completely transhumant. The 13 fully settled clusters sent their livestock north on transhumance with members of other minimal lineages to whom they were closely related. Some settled households may join these fariqs, i.e., nomadize.

The largest herds were owned by the fully transhumant nomads, and the smallest belonged to the fully settled farmers. The majority of middle-sized herds (60-100 cows) belonged to transhumant households, including those of sedentary relatives who entrusted their cows for the rainy

season trek.¹ Smaller herds (of less than 20 cows) were owned mainly by sedentary households. Some settled households owned no cows at all, but raised sheep and goats and used milk cows by belonging to transhumant kinsmen.

Although there is substantial overlap between these extended kin-group associations of transhumant and sedentary, at the household level the distinctions are drawn clearly. The transhumant household leads a very different way of life from its sedentary kinsman or affine. Reciprocal relations between them, stimulated by intermarriage and inheritance of livestock, permit circulation of individuals and cattle between the two systems. Sometimes new households of younger men drop out of the transhumant stream to become sedentary farmers or traders. In other cases, married sedentary men accumulate enough cattle, sheep and goats to join a fariq to which they are related and become transhumant. Even former Nuba herdsboys "nomadize" after learning the skills and acquiring some cattle from their labors for the Hawazma. In short, these two systems are interdependent. By taking advantage of kinship and marriage ties, members of both systems benefit in terms of living standards, wealth, and exchange of labor and reciprocal benefits over time.

¹ This situation reflects the observations made by Hunting Technical Services, (Volume III) July 1981, Report on South Kordofan, as follows: (Volume III)
"Today there are many important links between the sedentary and migratory populations. For the migratory pastoralists this involves herding cattle and also sheep for sedentary relatives. In some cases, the sedentary owner sends a son as a contribution to the (nomadic) labor force. . . . Another arrangement is between brothers or cousins who take turns to migrate and to cultivate. . . . The cultivating household may join the nomad camp for the dry season, and often the camp is in the same locality as the farm. The migratory household may also have a farm at which a large part of the work is done by hired laborers. Near Lagowa, Kadugli and smaller centers, they have almost all their main farms on clay soils. . . . (Some) pastoralists spend the dry season close to a related settlement and use the same water source as their sedentary relatives. Another characteristic of pastoralists in this system is their fairly frequent use of Nuba youths as hired herders. . . . It appears that the figures for the average number of cattle per family include an appreciable number of cattle belonging to sedentary relatives. . . . Sometimes cows in milk are removed to provide milk for sedentary households."

(20) Criteria for an Index of Quality of Life Among Transhumant Producer Households

The construction of a simplified set of indicators of the standard of living, or physical and social quality of life among transhumants must take into account socio-cultural values and pastoralist perceptions of well-being, as well as economic and consumption levels. This requires observation of both the dry season and wet season camps. Research is needed on settled housing areas where transhumants store their goods during the rainy season and where part of a transhumant household may live during much of the year.

(a) Wealth in Livestock: The herd is a source of capital, income, food and prestige. It is considered a buffer against economic vicissitudes, and insurance in case of ill health or death of a provider. As the major heritable goods in a transhumant household, livestock are the main medium for transfer of wealth over generations. As "walking capital" they increase the owner's wealth over time, if properly managed.

(b) Marketing: Castrated bulls and small stock sales appear to form the major income-producing resource in the household economy. Reproductive-age cows are not sold unless dire circumstances force them to be used for raising cash. Sterile or sick animals may be sold off. Cash earned from livestock sales is often reinvested in purchase of heifers for the herd.

(c) Cows-in-milk: Milk cows are highly valued for their contribution to the household and fariq diet, as well as for sale of milk products by transhumant women. Goat milk is used mainly for consumption by young children in the camp. The year-round availability of milk is a key element in transhumant perception of their quality of life; good milkers are very important animals. Purchase of feed supplements to stimulate greater milk production occurs in the dry season.

(d) In terms of food and beverage consumption, the quality of life is judged partly by milk use, and in part by the availability of staple grain foods, of which sorghum is the major ingredient. Hawazma transhumants prefer millet to sorghum, but they usually consume the less expensive sorghum while in South Kordofan. Rice and bread are considered luxury foods. Meat is also eaten in small quantities, except on festive occasions when a beast is slaughtered and the meat shared among all households in the camp, as well as guests. Small ruminants and domestic fowl are the most common meat animals.

Very important in the perception of quality of life is the consumption and serving to guests of sugared tea and coffee or sweetened (flavored) water beverages. These items of hospitality are much appreciated; but, require regular expenditures of sums of cash at market, since they are not produced by transhumants. Sugar consumption in particular, represents a critical measure of perceived quality of life. The ability to provide these items in a generous manner as a form of hospitality is a measure of a household's prestige, as well as economic well-being. Alcoholic beverages are forbidden to Hawazma Muslims and imbibers are held in low esteem.

(e) The quality of life in a compound household includes the ability of the provider to maintain his dependents among the component minimal household units. Each tent is managed by a woman - his wives or close kinswomen. The number of wives and their children represents a criterion for the social standing of the male provider. The acquisition of two (and often three) wives is seen as a valued goal by men. Few take the allowable four wives, as the additional woman serves no economically or socially necessary purpose. Numbers alone are not the perceived criteria. Two to three wives provide labor for diversification of a man's economic enterprises. When one woman is pregnant or post-partum, another wife is available for domestic functions and sexual relations, a third may maintain a settled household, etc.

(f) As a man's children grow, they are brought into the division of labor in herding and cultivation. Sons perform as herdboys and older sons (and daughters) work in the rainy season cultivations. If one

wife and her children can be housed in a sedentary community, jubraka garden produce, as well as the grain crops can be raised. Number of children is an indicator of well-being overall, but the economic utility of grown children is especially sought after. Once married, sons are expected to contribute to their aging parents' needs through provision of regular sums of cash or goods. Marriage of daughters to kinsmen with many head of livestock or good jobs is preferred.

(g) In modern times education of children has taken on much value among the Hawazma transhumants. The educational level of grown children and the kinds of occupations they are able to find as a result are deemed important. The ability of the parents to send their younger boys (and occasionally their younger daughters) to school, rather than employ them as herders or household workers, shows the enhanced level of wealth of the household and its progressive attitudes. Most compound households contain at least one minimal unit housed in or near an urban community where schools are available. Children of the expanded family are cared for by a man's co-wife or female dependent while attending school. This, too, is a measure of the family's well being.

(h) Itemized List of Quality of Life Index Among Transhumants¹

[1] Material Culture and Physical Aspects

[a] Wet Season (in Transhumance)

Housing

Sheltering Materials (mats, tarps, thatch) and Quality
Number of housing units and types (e.g. rakubas)
Interior space

¹ This list was compiled primarily by the Associate-in-Research, Barbara Michael, supervised by the Senior Social Scientist.

Furnishings

angoraibs (bed)
diringls (large beds)
bambara (stools)
storage containers or racks
mats
blankets, pillows

Household Goods

Bouksa (container)
coffee service
tea service
mortars and pestles
cooking pots
utensils (knives, stirers,
etc.)
food serving dishes
water carrying containers
charcoal brazier
metal cooking sheet
tabaks (basketry food covers)
traditional leather goods

[b] Dry Season (stored items in
addition to transhumance items)

Housing Type (jahoba, humar,
rakuba, other)

Furnishings

iron beds
mattress
wooden metal side tables
large wooden table
clothes horse
bed linens

Household Goods

tea service
coffee service
cooking pots
serving dishes
trays (types, sizes)
drinking glasses
buckets
metal storage boxes

[c] Food and Water

Household produce

sorghum (amount consumed)
milk/milk products
household consumption
sales
meat (amount consumed)

Purchased products

sorghum/millet
meat (occasionally)
vegetables (fresh/dried)
tea
coffee
sugar
spices
other manufactured/processed
foods

Water

amounts used and purposes
distance to and from source
quality

[d] Clothing

Men's and boys'

jellabias (gowns)
shawls, sweaters etc.
shirts
pants
socks
shoes

Women's and girls'

tobes
dresses
other head coverings
shoes

money spent each year

[e] Other Items

Radios/tape recorders
flashlights
lanterns
tools
watches
jewelry

[f] Transportation Used

Beasts of burden
Bicycles
Trucks/lorries
Feet

[2] Livestock (Size and composition of herd)

[a] Cattle

-bulls
-milk cows
-riding/transport oxen

[b] Sheep

[c] Goats

[d] Donkeys

[e] Camels

[f] Chickens

[g] Supplementary feeding

[3] Dependents, Labor Supply, and Status

[a] Number of wives

[b] Number of children

-age groups

[c] Other dependents

[d] Hired Labor

- [e] Education (of household members) and literacy
 - boys
 - girls
 - adults
- [f] Leadership positions held, and standing in tribal unit
- [g] Fariq size (population, number of households)
- [h] Land cultivated (type and amount)
- [i] utilization of health services
- [j] Utilization of other services
 - veterinary
 - legal
 - social
- [k] Travel, pilgrimages
- [l] Wage labor away from fariq
- [m] Other sources of income

(21) Hawazma Tribal and Lineage Institutions

A brief anthropological background on lineage principles among Hawazma transhumants is presented here. Traditional institutions are used to control conflict between transhumant groups and settle disputes with sedentary populations located along the migration routes. Patrilineal groupings function to maintain the production system of livestock and crops and ensure safe passage of fariqs during their treks. Historically, these tribal and lineage institutions served the larger purpose of regulating political relations within the transhumant system and between the sedentary system and the nomads. However, with various changes in administration since independence, there is evidence that these functions have broken down, increasing societal constraints on production and accelerating adverse environmental impacts.

Each group of patrilineal descendants, about three generations of men and their immediate ancestors in the male line, consider themselves to be a minor lineage. They are tied together by common "blood" and by inheritance of names and property, mainly livestock and agricultural land. This kinship and descent unit is called an "iyal rajil" ("sons of a man" who is their deceased founder about five generations back). Ideally, a transhumant fariq is formed from households belonging to this lineage group. In fact, not all members of the minimal lineage enter the transhumant stream, as more than half the Hawazama are sedentary, today. No man is forced to live in the fariq of his minimal lineage; but, member households with herds for transhumance usually value this form of cooperative association in production and as a way of life. (Also see Cunnison, 1966)

As a transhumant camp grows large in numbers of compound households and livestock, it must split into smaller operational units for grazing and migration purposes. The split is usually made along patrilineal descent lines, i.e. new minimal lineages are formed to account for the new fariq organizations. In other words, the principle of genealogical descent is used to justify the economic and social production units in this system, which change over time and in response to environmental conditions. The minimal lineage uses a kinship idiom for the down-to-earth business of cooperation in livestock (and crop) raising at the level of the fariq.

Male household heads in a fariq are actually linked by a variety of marital, kinship and friendship bonds in addition to, or in place of patrilineal descent. The social basis for their continuity is the inheritance of livestock (mainly cattle) and cropland amongst themselves over time. Their highly endogamous marriage practices (i.e. most men marry their close patrilateral cousins) preserves livestock and property alliances in each generation. This maintains the composition of herds despite death and Islamic inheritance rules, as women give up their property rights through customary means.

At a wider level (several fariqs and associated sedentary kin households) are major lineage groups which band together to receive blood-debts in the form of cattle transfers from other lineage segments of Hawazma tribal sections. Cattle are collected from lineage household heads and ceremonially handed over to compensate for murder or maiming of a lineage member by a man from another lineage. The payment serves as a form of social insurance. It also dissuades men from committing violence by exacting a cost in their most valuable form of property, a representative cattle herd. Lineages belong to named tribal sections which together form the Hawazma Federation or tribe, based on the blood debt pact.

(22) Cattle Blood Debts

The following is a brief description of the observed Hawazma blood-debt rules and an explanation of their function in perpetuating the transhumant system. The ostensible purpose of the blood-debt institution (Dia) is to compensate families and lineages for human losses due to violence and murder, and to preserve the peace by deterring acts of violence. Traditionally, this set of customary practices also served as the basis for tribal political relations among sedentary lineages and for treaties between tribes.

The institution is based on mutual agreement sealed by a solemn oath taken on the Koran by the leading men of a descent group to cooperate in the payment and receipt of cattle for damages. According to the formula, cattle are handed over in a ceremonial gathering when a member of the injured lineage makes a justified claim against the perpetrator's group. At this ceremony, an ox is also offered by the paying group as a sacrifice to feast the intermediaries from neutral lineages who arrange the settlement and restore peace between the opposing lineages.

Within the Hawazma tribe (and between the Hawazma and other Baggara tribes in Western Sudan) the payment for death of a man is 60 head of cattle,¹ distributed as follows:

9	one-year old		
	female calves, plus	1	male calf
9	two-year old		
	female calves, plus	1	male calf
9	three-year old		
	heifers, plus	1	steer
9	four-year old		
	heifers, plus	1	steer
9	prima-para		
	cows, plus	1	bull or ox
9	twice-calved		
	cows, plus	1	bull
—			—
54		plus	6
	equals 60 head of cattle.		

The minor lineage of the perpetrator must contribute one-third of the cattle. The remainder come from the major lineage members, or the entire tribal section or tribe, depending on the level of lineage segmentation at which the murder took place. When there are more payees than cattle required, money is contributed by each household head to buy the required number and types of cows and thus settle the feud. If a death occurs between members of a minor lineage, no blood-debt is paid. Some lineages have standing agreements to share blood-debts, and under certain circumstances people

¹ A woman's death is compensated at half that of a man, and injuries of various sorts require indemnities of 1 to 15 cows each, with a maximum cost no greater than that of the death value. With some Nuba tribes, the Hawazma have a compensation formula calling for payment of 15 head of cattle for a man's death. There are many further details that cannot be summarized here.

who pay cattle also receive other cattle in the same transaction. In general, cattle settlements are intended to preserve the peace between associated lineage groupings so that they may safely graze their animals on the common range, transhume over the same routes, water their animals at the public waterpoints, meet peaceably in markets and public institutions, and not engage in further violence.

A blood-feud can erupt when more than one murder occurs between major lineages or tribal sections over a number of years despite attempts at peaceful blood-debt compensation. This may happen when a particularly flagrant abuse of the peace oath takes place and vengeance is sought by the injured group. In modern independent times, vengeance is often pursued through the governmental courts, i.e. a death sentence is sought by the victim's lineage. In case of a sentence to execute the murderer, no blood-debt is paid in compensation for the homicide, but the blood-feud continues. Usually, the two groups attempt to prevent this dangerous situation by seeking only a prison term for the convicted man, and then paying the blood-debt. Once the required cattle have been transferred, the victim's family joins with that of the convicted man in seeking a reduced sentence.

In this way, their peaceful relationship can be maintained and the man go free after a few years. However, court cases may drag on for one or two years of litigation before sentencing. During this time, range-livestock and socio-economic interactions between aggrieved fariqs from the two opposed lineages remain tense. Normal daily activities between sedentary neighbors from the two lineages may also be disrupted. The victim's lineage will insist that the criminal's minor lineage be removed from their shared transhumant route and grazing areas, i.e., that their fariqs be displaced to another migration orbit and different markets, so as to prevent clashes. This move may be often imposed by the provincial authorities, which means (at least temporary) disruption of the production system until the fariqs adjust to the new environment of transhumance. Once the case is settled with a blood-debt payment displaced transhumant camps can move back to their original grazing areas, if they wish, and resume amicable relations.

(23) "Native Administration," and the Effects of Government Policy Change

Observation shows Sudan governmental systems of justice and administration interact intimately with Hawazma customary tribal methods. The authorities impose a semblance of peaceful coexistence between transhumant groupings and allow the production process to continue. A major historical impact of the colonial period was establishment of British "indirect rule" (in 1911) for Western Sudan. The Condominium government created three levels of "native" officials to administer the sparsely populated tribal groupings in the Kordofan. The sheikhs, at the fariq level, represent the minimal lineage group and assist in tax collection on herds. The next governmental level was called the Omda, assigned to a tribal section or major lineage of the Hawazma, with judicial authority according to customary law and tax collection responsibilities. The Nazir was made the official chief of a tribe or sub-tribe, with responsibility for the territory in which the tribe lived in relation to other tribes and to the colonial government. Nazirs and Omdas were transformed into hereditary offices and became dominant family groups or elites within their tribes. Sheikhs changed in more democrataic fashion as fariq units grew and split over time (See Cunnison, 1960).

As described in the Milner Report to the Sudan Condominium government (1920) this "Native Administration" system was set up for the nomadic tribes of Western Sudan to reduce the cost of government and to keep the administration decentralized and in touch with local customary conditions. The colonial and post-independence governments, until 1969, used tribal and lineage structures for the following purposes according to Abdallah, 1982:

(a) for fines due to cattle trespass on crops

(b) for livestock census-taking and head-tax on cattle, small ruminants and beasts of burden

(c) for mass inoculation of cattle and small ruminants

(d) for judicial resolution of conflicts and maintenance of order

(e) for upholding communal grazing area rights and local land rights in the tribe and separating the territories of nomadic and sedentary tribes.

These administrative and public order objectives served to perpetuate the transhumant system and institutionalize it to the benefit of the government, and to tax and service the growing population. The "Native Administration" also served as an income source for native officials, such as Nazirs, Omdas and their retainers. It channelled ambitions, as individuals used their lineages to attain positions of authority; and it makes them subject to control by the Condominium's District Officers, backed by police and military force, if needed.

The Nazir's position did not affect tribal structure significantly, but creation of the omodiyas had the effect of "freezing" the major lineages or tribal sections, each with an Omda at the head. It tended to equalize lineages which had previously been ranked by traditional political relationships. The Omdas also transformed the basically leaderless lineage groups into stratified authority structures headed by an hereditary elite (Cunnison, 1960). The system stimulated the marketing of livestock in the growing urban areas of Kordofan and export of cattle and sheep to Omdurman for meat. It also allowed the introduction of cash-cropping on mechanized schemes by government fiat over unregistered communal lands, which encouraged the sedentarization of large numbers of Hawazma transhumants in South Kordofan.

After the May 25, 1969, revolution and establishment of the Nimeiri government, the "Native Administration" system was abolished. Its former tribal elites were prevented from assuming posts of leadership in the new provincial and local government organizations; as well as the Sudanese Socialist Union political party. Various changes introduced previously eroded the power of the omdas by making them salaried employees and withdrawing their tax collection privileges. The only remaining office in the system is that of the transhumant camp sheikh, who continues to collect taxes, but has no judicial authority. Today, local councils and courts have replaced the traditional nomadic administration system. Their territorial boundaries effectively prevent transhumant groups from participating in governmental processes on a year-round basis.

A decade after these reforms, policymakers in the Kordofan Regional Government have raised questions about the effectiveness of the current administrative system for nomadic populations. Their analysis suggests that the following tendencies toward disintegration accelerated in recent years, according to Jamma'a, (1982):

(a) Inter-tribal relations have weakened and tribal conflicts over land use, water access, and livestock movements have increased exponentially since 1970. Transhumant-sedentary conflicts increased precipitously, as cattle damaged crops and local courts assessed heavy fines on the transhumant owners.

(b) Security and public order have deteriorated with increase in inter-personal crimes among pastoral nomads, including cattle theft, injury and murder. The existing judicial institutions have not been able to contain the impacts within narrow family limits, resulting in conflict between lineages and tribal sections, and even intertribal warfare.

An "arms race" has emerged between pastoral tribes, such as the Messiriya Humr and the Rezeigat, over the use of transhumant grazing resources in Western Sudan. Modern-day tribal reconciliation conferences

have been unable to settle conflicts between these Baggara tribes. Between 1970 and 1980, there were 41 costly conferences among the Messiriya for which the agreements could not be implemented, resulting in break-down of order again and again. By contrast, between 1950 and 1970, only five such peace conferences were held, and they maintained order on the range for many years (Jama'a, 1982).

According to Abdallah (1982), reasons for breakdown in tribal relations and intra-tribal disorder include:

(a) the removal of tribal elites and a weakening of tribesmen's respect for "peoples courts" that do not take into account customary law. Customary laws created barriers between tribes and competing production systems in terms of land and water use. Since abolition, there are no government sanctions to prevent abuses of traditional land use patterns.

(b) Central administration officials were assigned to govern nomadic communities. Their urban socio-economic background and outsider status and training made them unsuitable to the transhumant "ecological" content. Decisions were made on a biased basis, tending to favor settled groups over nomads.

(c) Police and security forces were unable to extend their coverage throughout the pastoral areas due to the large spaces to be covered and the unsettled movements of transhumant and other nomadic groups. Security of livestock against thievery declined, range burning and tree-cutting increased, and conflicts between individuals and groups went uncontrolled.

After his recent tour of the Hawazma migration routes to determine the cause of problems brought to the Kordofan legislature for the Ministry of Agriculture, Dr. Suleiman Abdallah, the Director of Natural Resources for the Kordofan Ministry of Agriculture and Natural Resources, wrote in a report in 1982 as follows:¹

¹ Translation from the Arabic by Mohamed Azeem Abu-Sabah, WSARP, Kadugli.

"Transhumant nomads formerly fell within the Native Administration system and were regulated through their tribal leadership, the Nazir/Omda/Sheikh structures, with jurisdiction over large territorial zones. The leaders understood the needs of nomads and sedentaries and kept them apart. The new system does not assign nomads to any local areas as they cross administrative boundaries. The system does not lend itself to resolving their conflicts of these mobile people with livestock.

Land use under the Native Administration was subject to tribal custom, but the new system now favors sedentaries through the law. For example, gifar (communal grazing lands) are now open for any kind of investor to cultivate and now organizations control the use of former gifar lands. Elimination of the Native Administration was so complete that it cancelled tribal boundaries, took away customary rules and broke down barriers between different populations, causing rangeland havoc. It assisted selfish interests of individuals who took advantage of others in the group. There is an administrative gap here. . . . Since people are no longer obliged to follow customary law regulations, conflicts between them become more acute. . . There is no general policy to guide land use, no common law, and only random unplanned expansion of agriculture goes on."

In short, various government policy and administrative changes since independence have led to additional constraints on rangeland livestock production, which adversely affects output by transhumant producers. As increasing numbers of sedentary cultivators spill over into rangelands, blocking trek routes; others grow gardens around watering points, the transhumant mode of land use is seriously threatened.

The environment deteriorates; the yield of range vegetation declines, due to burning, erosion and lower soil fertility. Increased implantation of mechanized farming schemes on former common land decreases the area available for grazing. Greater numbers of livestock on the

open range leads to overgrazing in certain areas. This is particularly noticeable in the fragile ecosystem of North Kordofan with its lower rainfall. Overgrazing in association with unwarranted cultivation and erosion can lead to irreversible loss of range resources through desertification (Bunderson, 1981).

The Farming Systems Research approach is not suited to make interventions in these large-scale intersystem contexts. WSARP researchers perform studies that may point out the policy areas through which government can better manage land use, decrease disorder, and mitigate conflicts between user groups so as to improve production. Policy changes may benefit the transhumant producers and others, as well as preserve the environment.

(24) Recommendation Domains for Interventions with Transhumant Households

Diagnostic studies of transhumance in South Kordofan have preliminarily identified at least three types of pastoralists: (1) mainstream transhumant households; (2) sedentarizing households, and (3) nomadizing households.

Each of these groupings can be characterized in farming systems terms for choice of intervention termed recommendation domains (See Collinson, 1982), as follows:

(a) The mainstream transhumant households live in camping groups of several households, making steady migratory movements each year within the same north-south orbit. Households keep stable or slightly growing herds of 100 or more cattle per compound unit, half as many sheep and a few dozen goats. The headman is usually middle-aged with two or three wives.

The economic mainstay of the compound household consists of livestock sales and sale of milk products by women. Cropping is quite secondary, a partial subsistence strategy with low inputs and low, but useful, foodcrop outputs. Few mainstream nomads plant labor-demanding cash crops like cotton.

These households may change encampments several times a year in response to rainfall, grazing or need to escape disease. They spend longer on the migration to the north and back than do sedentary groups. They are very market-oriented and are responsive to short-term gains in production, which they see as raising their wealth in livestock.

(b) The second homogeneous grouping is the sedentarizing household type. Here the migratory movements to the north are more variable from year to year, and the household may change its migration route to accommodate its labor and demographic situation. Households have herds of about 50 head of cattle each, with fewer sheep and goats. The household head is usually a middle-aged or older man with, at most, two wives. One of these wives lives in a sedentary community year-round, while the other goes on transhumance. Some years the household head remains behind to cultivate and sends only part of his household on the trek to North Kordofan. He may visit the herd while it is in the north, but is not as deeply involved in marketing as are mainstream transhumants.

This type of producer is interested in expanding his production of food crops to feed his household members (of which there are usually fewer than in the mainstream case). He may also be able to raise a cash crop for sale, and may own a stationary enterprise in South Kordofan, such as a sesame press, a small shop, etc. His family raises a house garden (jubraka) near their sedentary home.

(c) The third type of recommendation domain is the "nomadizing" or recently semi-nomadic household. The men and boys trek livestock north during the rainy season, although they were formerly settled farmers. They have accumulated at least 30 head of cattle and are trying to increase their herd. The man may be younger, recently married with minimal numbers of dependents, often a nuclear family only. The wife (or wives) remains in a sedentary house during the rainy season to work on jubraka, and share in the work on grainfields with kinsmen. As they become more nomadic, the man may join a fariq and one wife may begin to transhume with the camping group.

However, their migrations are precarious; they often travel with their livestock alone, and herds are more subject to loss through disease, accident, or mismanagement due to lack of knowledge of the northern ecology. New nomads are less experienced in the livestock marketing system. Their wives do not specialize in milk sales.

The concept of recommendation domains for transhumants is adapted from the Farming Systems Approach suggested by Michael Collinson and others (Collinson, 1982) to selection of a homogeneous grouping of farmers operating similar production strategies on similar sites. Although transhumants are not 'local-specific' farmers because of their mobility, their groupings do have similar agro-climatic characteristics and economic and social strategies as well as other socio-demographic traits in common. Each group tends to have similarities and differences (which may change over time). Biases in selection of these initial groupings of pastoralists probably favor those camped close to the Kadugli Research Station in the dry season, due to a lack of vehicular transportation during the diagnostic phases. This means selection in favor of Hawazma transhumants, the major ethnic group in the Kadugli area, rather than Messiriya or Nuba groups.¹

c. Preliminary Conclusions

The major production strategies (socio-economic enterprises) of transhumant Hawazma households depend on extensive rangeland rearing of livestock: cattle, sheep and goats. A subsidiary agricultural enterprise is low-input, bush-fallow cultivation of food crops while engaged in the transhumant trek. Livestock sales generate the major source of income for household consumption purposes; also sales are made for renewal of the breeding stock through purchase of animals and for meeting input costs involved in animal feeding and health care. Cash from annual sales pays livestock taxes and fines, as well as the input and labor costs of small-scale cultivation.

¹ It is important for Farming Systems researchers to try to identify and acknowledge observable researcher biases in the selection of human groups for study. Then these characteristics can be handled and adjusted to in processes of diagnosis and on-farm/in-herd interventions and testing of technology.

However, livestock are kept not only for their live market value, but as a capital investment with dividends (by-products) of milk products, meat, hides, and (sometimes) manure. Beasts of burden are kept for transport (camels and donkeys), but oxen are also used for baggage-carrying and riding in transhumance and grazing movements.

(1) Major Research Questions

Since social and economic factors in the organization of transhumant camps and households appear to be key to their nomadic production system as a way of life, to what extent does transhumance depend on this socio-economic organization?

Observations suggest that the maintenance of transhumance appears to depend on the following mix of customary and evolving practices and attitudes:

(a) Cattle:

While men manage livestock and adolescent boys perform many herding duties, women milk cows and goats, process the milk products, and make sales of milk and clarified butter. A mixture of competing and complementary objectives characterizes this production system. Cows are bred to obtain calves and milk. The milk is shared approximately half-and-half between human and calf use. Female calves are raised to join the breeding herd. Male calves provide a few bulls and many castrates. Oxen are needed as beasts of burden, as herd leaders and symbols of prestige, and are the main animals marketed to raise cash. Sick or sterile cows may be culled; replacements are purchased, where possible. Although attempts are made to increase the size of the breeding herd, competing objectives often intervene to slow herd growth. Some herds are overstocked to minimize the risk of loss from disease or malnutrition.

Cattle (mainly oxen) are the main source of market animals during the rainy season selling peak in North Kordofan. However, small ruminants (sheep and goats) are an important income source, especially during the dry season in South Kordofan. Income is also earned by use of camels as beasts of burden to haul crops during the harvest season. Milk income for women derives from sales of fresh milk to cheese factories in the north, and sale of milk and butter during the dry season in the south. Animals are supplemented with purchased oilseed cake feeds in the dry season to increase milk output or prevent malnutrition.

(b) Crops:

Subsistence varieties of sorghum, sesame and cowpeas are hoe-cultivated. Processed foodstuffs (as well as supplementary food grains in most years) are purchased as households do not usually produce a variety of food for their needs. Due to movement of household members to the north, farmplots often require hired labor to perform weeding and other rainy season operations.

(c) Household Management

Men control the herding and cultivation operations drawing on women and children for special labor needs. Women manage their household domestic activities and care for children, small calves and domestic fowl. An adult married man supervises the livestock of his own tents (wives and children) and is also the provider and manager for his close female dependents and their immature offspring. Together, a few minimal households managed by women make up the compound household overseen by a man. Several of these larger households (usually related by descent and marriage) band together to transhume as a cooperative unit of production, the fariq between southern clay plains and northern sandy plains in response to seasonal rainfall and grazing. These camping groups are mobile throughout the year, but tend to spend the longest time in the dry season living in large grass shelters near permanent water sources.

(d) Transhumant Movements:

Fariq camps move not only for their livestock, but to reach their cultivation areas during the transhumance and the harvest season. They follow definite routes or orbits between south and north Kordofan eco-zones, but also spend time camping near governmental and social services; markets (usually town or village based), schools for their children, health care facilities, law courts, and their tribal homeland. Transhumant herders are attracted to crop residues from sedentary cultivations in the dry season and to watering points near their grazing areas. The damages to field crops caused by their cattle may lead to punitive fines, range burning by settled farmers, and expulsion from watering points. These conflicts about grazing, water resources and land use with sedentary populations form major constraints to transhumant production. In particular the extension of mechanized farming has eliminated large areas of communal rangeland and squeezed the grazing areas available along the migration routes. Horticultural land uses have made access to well areas difficult for transhumant herds, as have mechanized farm demands for exclusive use of man-made water sources.

A second question is whether the socio-economic variables identified as perpetuating the transhumant system also control the processes of sedentarization and nomadizations?

Since transhumants do not own the range, they lack control over the natural resource base on which they depend for a living. Their opportunistic, mobile way of life increases the difficulties they face in maintaining the transhumant system in the face of encroachments. They lose land resources to outside investment and localized population pressures among the growing numbers of sedentary farmers. It appears more difficult to design interventions integrating livestock and crops in this moving system than for sedentary populations which can more or less control their land base.

Transhumant producers currently own or manage the majority of productive livestock for commercial offtake in the Nuba mountains area. Hawazma nomads are market-oriented and participated regularly in the existing marketing system for livestock, grains, and consumer purchases in towns like Kadugli, Dilling and the city of El Obeid, as well as in village market centers along their migration routes. However, there are gaps in marketing that relate to the livestock-rearing system of transhumance. The transhumant herd is mainly a breeding herd, with animals of all ages from calves to stock over 12 years of age. Although transhumants try to buy reproductive-age cows, they are scarce on the market, or of a very poor quality.

As far as is known, there are no specialized herds that raise replacement cows for market. Also, there are no stud farms, where bulls are raised that could improve the production characteristics of inbred Hawazma herds through hybridization. Although it takes many years to raise an ox to maturity, the practice of selling younger steers or castrates for fattening is not well developed in the Kordofan. Hence, the prices received by cattle and sheep raisers do not reflect the added value of their animals that could be obtained by fattening or finishing in feedlots. Lastly, except for cheese factories in North Kordofan, there is no dairy infrastructure to improve milk yields and make use of seasonal surpluses of milk, except through direct channels to the consumer. The result is that transhumant producers are limited in the types of animals they can purchase and the age and sex of livestock they take to market, reducing turnover rate and profits.

Transhumant producers also have limited degrees of freedom in the number of cattle in their herds they can bring to market. This is a function of herd size and composition, as well as the legal and social obligations that cattle represent, i.e., the need for milk cows for fariq households and related sedentary households; the ownership of some cows within a man's herd by women and other dependents; payments to herdboys; forms

of entrustment and/or patrimonial rights of immature children; and the need to reserve animals for ceremonial occasion slaughter, as well as for payment of blood-debts.

(e) Finally, the risks associated with livestock raising in terms of early death, disease epidemics, lost or stolen animals, and low rates of calving due to poor nutritional condition of cows, oblige households to maintain larger numbers than might otherwise be optimal, preventing timely culling of the herds. Although stockmen attempt to build their herds, they must actually fulfill a number of competing short-term needs and derived benefits that limit the rate of herd growth, as well as do without inputs that could stimulate faster increase in numbers.

Another question is whether the introduction of socially sound and economically feasible technical interventions at the household and camp level can improve production and lead to greater commercial offtake of livestock through existing market channels? Preliminary conclusions are as follows:

Attempts to transform this production system by radical change such as sedentarization or development of cattle ranches have not succeeded among Sudanese transhumants in the past. Restriction of the transhumant migration could result in break-up of the fariq camps and dispersion of their herds. Such radical technical or policy changes would not be socially sound or economically feasible. They are likely to have short-term adverse effects on diet and income that would lead to resistance and evasion, but the intended longer-term benefits may never be realized (Teitelbaum, 1981).

It would be a mistake, however, to suggest that transhumant households are hidebound anachronisms unwilling to experiment with techniques for increasing the quality and peer animal unit production of their herds. Indications from diagnostic research in South Kordofan are that homogenous groupings of mainstream and sedentarizing transhumant households will adopt appropriate technical changes including:

- (1) improved animal supplementary feeding
- (2) animal health improvements
- (3) improved husbandry and grazing patterns
- (4) introduction of improved genetic stock
- (5) cultivation of forage legumes for livestock feed, and better soil fertility

Transhumant graziers have access to relatively large reserves of capital, through the fungibility of their livestock sales. They can invest money in herd and other improvements. At present, they lack confidence in new innovations, unless they can perceive short-term, as well as longer-term benefits to their herds and their way of life. As they do not control the natural resource base for range management, this is not an area in which they will risk investment.

However, nomads are concerned about encroachment by mechanized schemes and sedentary cultivators; which suggests that modifications could lead to improvement in production. Farming Systems Policy research and recommendations can help remedy the imbalances in land use and preserve the environment against deterioration, while providing near-term benefits to transhumants, such as improved grazing and water in underutilized locales.

Another question is whether sustainable rangeland productivity in South Kordofan favors the maintenance of transhumant livestock in the Nuba Mountains region (Southern District) during part of the rainy season. . . the preliminary conclusions are:

A strategic set of smaller-scale farming systems type interventions could stimulate a short-term rebound in the transhumant production system. This would encourage further changes over time by the process of successive approximations and increasing incentives to raise commercial offtake. Part of the longer-term strategy would be to increase the length of time the majority of a household's herd spends in South Kordofan at the beginning and end of the rainy season, and gradually decrease the pressure on the overgrazed fragile range resources of Northern Kordofan (Bunderson, WSARP).

Major incentives to encourage this migratory shift over time include: (1) new technical interventions to reduce the insect pest and disease vector problems during the rainy season on cracking clay soils and (2) relocation of important livestock markets and dairy facilities such as cheese factories in South Kordofan to attract producers during the rainy season.

Conflicts with sedentary farmers during the cropping season are another major factor pushing transhumants to move away from cultivated areas in South Kordofan. The provision of demarcated grazing and migration routes that forbid cultivation would assist in the process of encouraging longer stays in the Nuba Mountains area. Better integration of livestock and crops through guaranteed access (for payment) to crop residues and restricting burning of crop stubble and grasses would assist in the objective of keeping livestock near the forage resources of the area. Improvements in local government representation of nomadic groups would help in making these integrative crop-livestock arrangements, including the production and sale of forage legumes for livestock consumption.

The problems caused by deterioration of inter-tribal and tribal section relations among transhumant groups due to interpersonal violence can best be overcome by improved attention to customary law on the part of government authorities, and by more rapid court actions to decide cases. Reinstating men of tribal standing in positions of some authority would help in containing frictions within tribes that spill over into range conflicts. Tribal cooperation could improve the tax base for government operations to maintain order and provide essential services at the local level.

d. Projected Activities for the Forthcoming Year

This report covers the research period from November, 1982, to March, 1983, less than half the annual cycle. During the upcoming workplan period (through June, 1984) the most active seasons of transhumant life occur, as well as the season of greatest biological stress. The hot, dry season (March to May, 1983) will be a period for examining the manner in which transhumants cope with the dearth of grazing and water resources during a time of extremely high temperatures and lack of resources. No cropping component is expected to be studied during this dry period.

With the spring rains (May-June) it is anticipated that transhumants will seek fresh surface water sources and leftover grazing, as well as new forage; this is to be studied. The early part of the rainy season (mid-June through early August) is the period for transhumant movement north and for planting and weeding of cultivations, the most labor-consuming period in transhumant activity. It requires intensive observation of these practices and their interactions as part of the system.

The late rains (August to mid-October) involve the period of time spent in North Kordofan on limited grazing areas near livestock marketing towns and cheese factories. This calls for a special support thrust study by the University of Khartoum on the marketing process in specific North

Kordofan locations used by panel transhumant households, as well as an understanding of the incentives to offtake for the transhumants during this season. The return trek southward with herds, followed by the anticipated early harvest of grain crops in the November/December period required follow-up diagnostic study.

Social scientists, at times working in tandem with agricultural scientists in-herd and on-farm, will follow these household and camp movements and production activities during this time period, recording the data according to the informal topics or data points shown in the Procedures (Section 7). Also, cooperation with other WSARP scientists and Ministry of Agriculture staff in the region will help shape the kinds of interventions judged most likely to succeed through a production systems approach, then monitor their effects. With aid of a consultant and formal survey (if appropriate), a simplified index of quality of life will be constructed and used to measure the impacts of project interventions.

e. Intervention Monitoring

Decisions to initiate farming system interventions in 1983-84, thus far include the mainstream and sedentarizing recommendation domains of transhumant households. Nomadizing households are not considered appropriate for interventions at present, due to lack of data.

For mainstream households, the first step is to introduce (in 1983) hay-making and hay-feeding to improve animal nutrition (Bunderson, WSARP). The in-herd experiment is to be farmer/herder managed, with preliminary demonstration of natural hay cut by research station range science staff in 1983. Supplementary in-herd feed trials will be attempted during the next dry season 1983-84, using hay and other locally available feed mixtures judged to be technically effective and acceptable from on-station trials, and diagnostic surveys.

One feedstuff, the mash from sorghum beer-making, was determined through reconnaissance by the social scientist and Animal Nutritionist, Babo Fadlalla, to be culturally unacceptable among Hawazma transhumants because of their Islamic repugnance to alcoholic beverages.¹ However, this nutritious, inexpensive feed supplement may be more useful to sedentary livestock raisers for whom religious objections are not serious cultural constraints.

The other recommendation domain is the sedentarizing type of household. With cooperators selected from nearby Hawazma communities, an improved package of practices for sorghum will be supplied as a superimposed on-farm trial in 1983 cropping season. Also, a forage legume trial will be carried out with sedentarizing households on fallow land to provide dry season fodder for livestock returning from transhumance and to improve soil fertility for later crop rotation (See WSARP, Experiments Nos. 6 and 4).

Among both mainstream and sedentarizing households, diagnostic data on milk yields of cattle is to be collected to determine the baseline for later experiments with supplementary feeds in order to demonstrate short-term benefits (Bunderson and Michael, WSARP). Also, socio-economic characteristics of milking practices will be diagnosed for each recommendation domain.

Additional interventions will be monitored as they are designed and implemented, with emphasis on the impacts of these techniques in creating short-term benefits and raising the level of perceived productivity of livestock and crops among transhumant producers.

¹ Hawazma believe that alcoholic residues (odors and taste) in sorghum mash consumed by cows contaminate cattle flesh and pass through into the milk rendering these foods taboo. Also, the use of alcoholic feeds in a Hawazma camp is believed to pollute the very air breathed by Muslims.

. Other Research Activities by the Senior Social Scientist

As WSARP social scientist, I participated with other scientists in research projects as a co-investigator during this reporting period. Central Thrust activities included preliminary exploration and design of the Sedentary Production Systems Survey (Experiment No. 2) from May to December, 1982 and the On-Farm Package of Practices for Increasing Sorghum Yields Study (Experiment No. 6) in February and March, 1983.

B. IDENTIFICATION OF RECOMMENDATION DOMAINS AND SELECTION OF FARMERS FOR WSARP ON-FARM TRIALS

1. Background¹

In the Nuba Mountain area of South Kordofan Province, cracking clays are the largest expanse of arable soils for rainfed farming. Traditional hoe-cultivators and tractorized farming schemes occupy much of the cracking clay plains between the ranges of Nuba Mountains. Traditional cultivators' yields are low, due to a variety of constraints. However, the tractorized farms leased from the government by tenants also produce low yields. The bush fallow system followed by traditional farmers allows several years' growth of grasses and bush between clearing and planting periods lasting about 5-8 years. The major crop sown is sorghum; local, late-maturing varieties of sorghum dominate the crop calendar.

The land use pattern is: Usually, fallow land is cleared and the residues burned off. The first year it is planted with late-maturing sesame. This is followed for the next several years with sorghum. As the land starts giving lower yields, the farmer returns it to bush fallow. New plots of land are opened and the process continues. No continuous "true" rotation is

¹ We were unable to zone in this farming system before identification of recommendation domains because of the need to initiate research efforts prior to the land-clearing season.

followed. Some intercropping of sorghum with cowpeas or sesame takes place as the sorghum yields begin to decline. Wild okra grows as a volunteer crop on sorghum fields where it is harvested for food. Some shade trees (such as Balanites) are allowed to grow on these elongated rectangular plots. Crop residues are burned during land preparation (See Tothill, 1948).

The main subsistence and cash crops are (in order of economic importance): sorghum (varieties), about two-thirds of the acreage planted each year; sesame, less than one-third of the acreage; cowpeas and curcurbits, intercropped with sorghum; okra, grows adventitiously. Although in the recent past, cotton was a major cash crop on cracking clays, it is infrequently planted by traditional farmers at present. Where tractorization schemes have taken over, cotton is a major crop, due to government requirements that it be raised (See WSARP, 1982).

2. The Target Population

The human population of the Central Districts of South Kordofan is relatively dense in rural areas. There are more than 23 persons per square kilometer here, compared to 7 persons/km² in the eastern and western districts of the province (Hunting Technical Services, 1981). The experimental area for on-farm trials contains farmers in need of per unit area increase in yields to raise their total production and the efficiency of the production process. This kind of improvement promises to raise their standard of living. The on-farm trials are slated to happen during the 1983 cropping season on cracking clay lands of farmers within a 20-mile radius of Kadugli. Kadugli, the major market and administrative town in South Kordofan, is the site of the WSARP Research Station.

Most of the traditional farmers belong to one of many Nuba Mountain tribal groupings, each of which maintains its own cultural heritage and has its own language or dialect. A village community is usually spread along the footslopes of a mountain chain, within 1-2 hours walking distance of the cracking clay fields on the plain below. Formerly, most Nuba tribes were hill-farmers who found refuge in the mountains from slaving and disorder in open

areas. With the establishment of peace and security in the Condominium period, villagers descended from the mountains in a process known as "downhill migration" (Roden, 1971). They moved to the footslopes and clay plains and began to engage in cash cropping, as well as subsistence farming. Their farming system does not integrate crops and livestock, although it once did so in the mountain environment through manuring of gardens and livestock use of crop residues, etc. Animal traction is not used by these traditional farmers. They are part of the Sedentary Production System defined by WSARP.

The next most frequent ethnic group (more than one-fourth of the population) is that of Baggara Arabic-speakers, most of whom have settled on, or near the clay plains in the past three generations. The Hawazma Confederation of the Baggara was largely a transhumant nomadic group that visited the grasslands of South Kordofan during the dry season, coming from North Kordofan. Today about one-third of the Hawazma remain nomads, transhuming between South Kordofan and North Kordofan with their family herds, but spending most of the year in South Kordofan (up to 8 months). They belong to the Transhumant Production System defined by WSARP as a group of livestock raisers who move seasonally with their herds, but also engaged in farming the land.

Sedentarized Baggara households and villages have become part of the Sedentary Production System. Although many own livestock, they do not move north with them during the rainy season. They send their animals away from the cracking clay plains to avoid flies, mud and growing crops, but confide them to the transhumants. This contrasts with traditional practice among the Nuba groups whose livestock spend the rainy season on the mountain tops near their villages. The main type of livestock for all these groups is the Zebu type of cattle (*Bos indicus*), with some breed differences between Baggara and Nuba cows. Sheep and goats are also raised. Some Nuba (non-Muslims) also raise pigs. The Baggara, by contrast, are very strong Muslims who avoid pigs as unclean, and do not use alcoholic beverages or smoke cigarettes. Many of the Nuba consume large quantities of sorghum beer as part of their diet. These variations in food preferences and other characteristics serve to distinguish

the population into target groups. Within broad target groups there are more homogeneous groupings, recommendation domains of farmers for whom the on-farm trials are planned.

This research focuses on three target groups: the Sedentary Nuba farmers; the Sedentary Baggara farmers; and the Transhumant Hawazma (Baggara) farmers.

3. Constraints to Production

Preliminary interdisciplinary diagnosis among farmers in the Kadugli area show the following major constraints to sorghum production (Agro-nomic information, Gingrich, WSARP).

- a. Low soil fertility
- b. Crop diseases (e.g. covered smut)
- c. Crop insect pests
- d. Vertebrate pests (especially birds)
- e. Poor quality of seedstock
- f. Too little or too much moisture in soil
- g. Labor bottlenecks at peak agricultural times
- h. Conflicts over access to crops by livestock
- i. Poor cultural practices, including late planting, late weeding and lack of mulching
- j. Inadequate farmer information

The constraints shown above were noted with regard to sorghum. However, farmers from different target groups did not list constraints equally. The priority also varied from one location to another. The list does not account for interaction of various constraints during the cropping season on the farmers' fields. The on-farm trials will address these issues and decision-making by farmers as they face actual constraint situations will be diagnosed. The preparation for on-farm trials requires a prior clustering of farmer types into recommendation domains in order to test technical inputs on homogeneous groups operating within similar agro-socio-economic contexts.

4. Recommendation Domains and Selection of Cooperators

Farmers were approached through their community sheikhs whose agreement was obtained to carry out the trials with individual farmers. The list of farmers interested in cooperating was obtained after a meeting of men from each village chosen for the study. These villages or communities were representative of the three main target groups shown above. They were:

a. Bilenya-Hajar Ranaba. Sedentary Nuba traditional farmers living in a footslope village west of the Kadugli Station. Four households chosen (Bunderson, WSARP).

b. Sha'er. A sedentary Baggara village living on sandy soils north of Kadugli. These traditional farmers also had access to a nearby mechanized scheme. An associated Nuba village, Seraf Iddae, farms similar soils and has access to the scheme. A total of four farm households chosen.

c. Hawazma sedentarizing transhumants from around Hamra. Hamra is a market town south of Kadugli. The farmer nomads were chosen because of their proximity to this community - Three households.

The criteria for the on-farm trial includes the homogeneous characteristics for each target group that made up the recommendation domain. Although this introduced certain selection biases, WSARP was aware of the biases and chose them deliberately, as they are considered representative of farming groups in the area (Kadugli Research Committee, WSARP).

a. Farmers fields and communities should be within short driving distance of the WSARP Kadugli Station, and accessible during the rainy season when roads are easily blocked with mud or water.

b. Farmers chosen should be full-time agriculturalists, heads of households, in the middle range of wealth, i.e. not too rich or too poor.

c. Farm households should possess adequate land, especially cracking clays to be able to offer up to one feddan for the experiment. Family labor should be involved in farming, although hired labor can be brought in, also.

d. Farmers should be willing to provide the labor inputs required by the improved package of practices. This is a "superimposed" on-farm trial in which researchers and farmers operate together.

e. No payments for land or crops are to be made to cooperating farmers. Improved seed, seed dressing, and supervision of cultural practices and advice will be provided.

f. Farmers will receive the yield from the experimental plots and will be interviewed for their perceptions of the technology and its production effects.

g. A small amount of improved Gadam El-Hamam sorghum seed (untreated) will be distributed for taste-testing by farm households before initiation of the trials and informal assessment of taste-preference by the social scientist.¹

5. Socio-Economic Aspects of Farmer Selection

In response to the approach and criteria used in selection of farmers for the on-farm trials, WSARP tended to attract farmers who were middle-aged or older. These are the majority of farmers in the communities visited. Some younger heads of households (under forty) are part-time farmers who engage in other occupations such as trade or salaried employment. Young men often participate in labor migration during the dry season. Many had not returned to South Kordofan at the time of the initial diagnosis in February-March, 1983.

Among sedentary farmers, older men also held more land in the cracking clays, hence were able to fulfill project criteria more easily. Household labor was more available to older farmers due to their larger number of children. Some also had more than one wife. Where sons had moved to towns, the father received cash remittances to use for hiring agricultural labor in place of the household labor component in some cases.

The traditional Nuba farmers depend more on communal labor (nafirs) for peak agricultural work requirements. The Baggara farmers (and those on schemes) tend to hire labor for peak activities.

Among transhumant farmers, most cooperators were also older men. There was a sedentarizing tendency amongst them. Men oriented toward regular transhumance did not show interest in this trial cropping, or were not available during the selection process, due to absence in their nomadic areas.

¹ All farm families questioned expressed a preference for this sorghum variety in terms of texture and taste of meals cooked in customary ways.

In short, certain biases crept into the selection of farmers for on-farm trials. Proximity to the Kadugli Station also biased the choice of farmers. However, awareness of these biases allows their characterization as part of the recommendation domain identification process.

6. Project Strategy

A major WSARP strategy in the cropping sub-system is to gradually introduce more frequent cropping of land. Crop rotation is a key component of this technical package. With increased fertility of the soil through rotation, a more reliable higher sorghum yield should result. Then, less land will be held in fallow for years at a time. By alleviating other specific constraints that interact to limit output, higher yields should reduce the land requirement and increase the per unit area production (WSARP, 1983).

Such an on-farm trial of sorghum varieties and package of practices has been initiated and fits within the major strategy line outlined above, using a minimum of imported materials. As sorghum yields rise, farmers should be more prepared to adopt other WSARP techniques, including rotation involving leguminous crops for food or forage. Soil fertility would be enhanced in this way. The first steps are to develop short-term, clearly perceived benefits that farmers can learn how to do themselves, via these trials. Observations of the interactions of various constraints will be made during the trials, and ways devised to overcome these constraints to optimize farmer benefits. Practices which at the first glance may appear to be improper land use, may turn out to have short-term benefits and to deal with constraints of which scientists are unaware. By bringing in some effective techniques to handle these constraints, cultural practices and labor problems can be better managed.

An associated on-farm trial with forage legumes (Experiment No. 13) is being carried out in some of these communities by the WSARP range scientist (Bunderson). Locally adapted forage legume seeds that require a minimum of labor inputs will be planted on fallow cracking clays. The purpose is

to offer a feed supply for livestock as well as improve soil fertility, and help integrate crops and livestock economically, and biologically. Success in this project also depends on a clear understanding of socio-economic aspects and the recommendation domains from which participating farmers are drawn.

C. OTHER SOCIAL SCIENCE ACTIVITIES

1. Participation in Research Meetings and Written Contributions

During the Annual Report period, the Social Scientist (Teitelbaum) attended numerous staff meetings to discuss WSARP project strategy and the Production Systems approach. Large scale meetings took place during visits to Kadugli by project leadership from Khartoum and Washington State University in April, 1982, October and November 1982, and March, 1983. The workplan strategy for social science research proposals on an interdisciplinary basis emerged from these meetings, and from readings in published Farming Systems Research articles and documents. Also, extremely useful inputs came from the combined efforts of the mid-Term Evaluation Team which met with Kadugli research staff in November, 1982, and prepared a report that assisted in making appropriate modifications to research proposals. During this period the Social Scientist wrote and revised the Transhumant Production Systems Panel Study (No. 15), and authored major portions of the original Sedentary Production Systems Survey (No. 2), including the entire literature review. I also contributed to other research proposals on which I was listed as a co-investigator.

I was an invited speaker representing WSARP at the February 20-24, Desertification Workshop at the University of Khartoum, sponsored by the Institute of Environmental Studies, EFTMA (U.S.AID) and SAREC (Swedish Aid). I delivered a paper at this workshop entitled, "Social-Cultural Factors in the Monitoring and Control of Desertification," in the session on "Sensing Social Systems." A copy of the paper is appended to this Annual Report (See Appendix I). I also participated in the workshop panel on integrating indicators of environmental degradation which reported to the final plenary session. The proceedings of this workshop will be published in 1983.

I contributed an article to the Kadugli Research Station Biweekly Digest Buhoth (Research) on the Settlement of populations in South Kordofan (Appendix I). A research paper was submitted to the ICAES meeting and accepted for presentation at this international congress in Canada in August, 1983. I shall attend as a representative of WSARP.

Other writing activities in which I was deeply involved were two of the three volumes of the WSARP Workplan (Volumes I and II) published by WSARP in 1982 (Publication No. 13). All senior Kadugli staff scientists made contributions to this interdisciplinary effort, which was coordinated by Dr. James J. Riley, Senior Advisor to the Director of the ARC.

During this period I have prepared Quarterly Reports, and other reports to project management. I regularly took minutes at Kadugli Station staff meetings (weekly) and prepared minutes for submission to the Station and Project Director and the senior staff. In addition to training of Sudanese staff at Kadugli Station, I began a Research Seminar Series that met monthly, beginning in 1983. I also served on the Station Library Committee, helping to set up the library facility and as an advisor to the Station Housing Committee.

2. Additional Social Science Activity

Social scientists will continue to work on the Kadugli Station Workplan research experiments through the end of the Workplan period in June, 1984. Social scientists will also assist the El Obeid station agricultural science staff in developing a sociological component to their work program and in performing rapid reconnaissance surveys in North Kordofan. When the Kadugli Station social scientists staff increases with the addition of Mr. Mohamed Abu Sabah, additional research proposals will be prepared.

The following research efforts have been planned:

a. Continue the Transhumant Production Systems Panel Study
(Experiment No. 15)

b. Participate in the following experiments:

- (1) No. 5. A Forage Legume Cropping System for the Cracking Clays of the Nuba Mountain Region
- (2) No. 9. Supplementary Feeding of Livestock During the Dry Season
- (3) No. 12. The Nature of Range Burning and Fire Control
- (4) No. 13. Range Use Patterns and Livestock Production of Transhumant Baggara and Sedentary Nuba Systems in South Kordofan
- (5) No. 18. On-farm Evaluation of Package of Practices for Increasing Sorghum Yields.

Also attached is the Research Calendar for the Associate-in-Research, Barbara Michael.

Barbara J. Michael

RESEARCH CALENDAR

May, 1983	Milk Production and Consumption	(#)
	Household Economic Studies	(#15)
	Demographic Studies	"
	Genealogical Studies	"
June, July, August, 1983	Household Economics on Trek North and in Northern Camps	(#15)
	Social Networks	"
	Marketing in North	"
	Case Studies	"
	Participant-Observation	"
Late August or Early September, 1983	Milk Production and Consumption	(#)
September, October, November, 1983	Household Economics in Southern Camps	(#15)
	Social Networks	"
	Cropping Activities of Transhumants	"
	Case Studies	"
	Environmental Degradation	(#12, 14)
December, 1983	Milk Production and Consumption	(#)
December, 1983, January, February, 1984	Cropping Activities of Transhumants	(#15)
	Social Networks	"
	Transhumant Herd Management and Decision-Making	"
	Marketing in South	"
March, 1984	Supplementary Feeding of Cows	(#9)
	Milk Production and Consumption	(#)
	Environmental Degradation	(#12, 14)
April, May, 1984	Preliminary Writing	(WSARP)
	Case Studies	(#15)
	Ceremonies	"
June, 1984	Social Networks (Transhumants/ Sedentaries in Rainy Season)	(#15)
	Case Studies (Sedentaries)	"
July, August, 1984	Report Writing	(WSARP)
	Data Checking/Consultation	(WSARP)

* (#) = New Proposal

APPENDIX I

Presented at Desertification Workshop, University of Khartoum,
February 20-24, 1983

Session on: SENSING SOCIAL SYSTEMS, Tuesday, February 22.

Chair: Mustapha Khogali

Paper Title: SOCIAL-CULTURAL FACTORS IN THE MONITORING AND CONTROL OF
DESERTIFICATION

Author: Joel M. Teitelbaum, Social Scientist, WSARP/Kadugli

This paper aims to point up appropriate social-cultural indicators of environmental change for rain-fed areas of Sudan, especially the savannah belt of Western Sudan. The goal is to provide a socio-economic and cultural set of markers for an interdisciplinary monitoring system to manage and control the desertification process. Desertification is a leading depressant on current and future sustained yield for Sudanese agriculture.

As part of the Western Sudan Agricultural Research Project, I work as a social scientist in an interdisciplinary team of scientists, agronomists, range ecologist, forester, animal production and nutrition specialist, agricultural economist, and water and soil scientists. We are focusing on a Production Systems, better known as the Farming Systems, approach to improving and sustaining yields for traditional farmers and herders in rain-fed Western Sudan. Most of the scientific team is currently at work in the Kadugli Research Station. The El Obeid Station will expand to become the project headquarters. As part of the Agricultural Research Corporation's intent to serve the Western Sudan, two new stations will open at El Fasher and Ghazala Gawazat next year to serve the Darfur region.

Several of the indicators which I will discuss below represent data sources to be collected by WSARP in order to measure change or impact of our Farming Systems research effort to overcome production constraints in agriculture. The purpose of these indicators is to provide baseline data and establish simple criteria for evaluation of the success of our project interventions. We will measure change in agricultural output and the rural environment, and in the level of living of the traditional producers, farmers and nomads, who make up our target population.

More information on the purpose and mission of WSARP is available in the lobby (WSARP brochures) or via discussion with staff members attending this workshop. As WSARP is a growing organization within the Agricultural Research Corporation, we welcome interest in positions within our interdisciplinary team by Sudanese scientists from a variety of environment-related agricultural-oriented

fields. Having briefly described my organization, I will address the indicators we are apt to employ and how I conceive of their utility in tandem with other indicators for assessing environmental change and monitoring the trend of change toward or away from desertification.

Some SOCIAL indicators can be viewed as independent measures of ecological processes that are the subject matter of disciplines such as my own anthropology and environmental science, or of sociologists, demographers, rural economists, agricultural economists and policy scientists. Examples of these phenomena which I shall term SOCIAL FACTS, include: tribal identities, traditions and belief systems; kinship networks and descent systems for inheritance and organization of agricultural activity; marriage and divorce conditions in rural communities, fertility parameters; income levels; education, quality of life and food consumption variables; statistics on health and morbidity, longevity and mortality of the rural labor force. Similarly, economic forces and market structures form important indices of the productive and consumption nexus involved in both subsistence agriculture and commercial exploitation of the savannah lands of Western Sudan. All of these become social indicators sin qua non because they derive from observation of social action by individuals formed into groups interacting with one another. Human actions have an impact on the environment from which people extract their life-support needs and upon which they build their social systems.

Other social indicators can be abstracted from biological or ecological factors, that is, transformed into social facts that parallel the biological system. For example, foresters measure changes in the density and distribution of trees such as *Acacia Senegal* (Hashab) as an indicator of botanical desertification. This creates the opportunity for social scientists to look at this phenomenon from a societal aspect: what are the labor and resource traditions indicated by loss of hashab for populations in Kordofan who traditionally depend on the collection of gum arabic as a dry season source of income? How does this affect social conditions, farming practices and land use? Biological facts are transmuted into socio-economic and cultural facts that serve as indicators to monitor environmental change.

Similarly, the occupational groups which engage in tree-felling, woodhauling on camel-back or truck and charcoal making, have distinct social and often ethnic characteristics throughout Western Sudan. While tree destruction is a pathway to ecological ruin, the tree-cutters form part of the declining ecological cycle. Their interests must be considered quantitatively and qualitatively in a monitoring system aimed at reversing the trend toward deforestation. Coincidentally, economic measures of the value of fuelwood, such as the weight transported to urban centers from the rural source, can identify key areas for intervention to control this process of environmental change when it gets out of hand in a region.

Another biological indicator is range and forest fires. This would seem to be an ultimate natural resource measure of environmental degradation. Yet, in reality, regular dry season firing of the grasslands, forests and entire hillsides in places like the Nuba Mountains may also be viewed as a cultural practice by groups of traditional cultivators. Burning is customary in Western Sudan. Its practice may be practical in the short run, and have magical

properties. Fire has become a strategic weapon used by sedentary farmers to ward off incursions on their grain fields by nomadic livestock. It becomes a social conflict indicator.

Another major geographic and natural set of resource indicators are the surface and sub-surface water resources of a region and their distribution and seasonal availability in the form of springs, shallow wells, pools and lakes, rivers and sub-surface wells or wateryard developments. These limiting resources are controlled or disputed by groups with competing interests, such as horticulturists planting irrigated gardens and orchards, livestock owners of various species needing dry season riparian water for their animals, and human uses of water for survival and hygiene. Water is a source of water-borne and water-washed disease for man and animals, also, hence its disease transmission capacity must be considered as a social indicator of environmental well-being.

The epidemiology of human, animal and plant diseases that kill or cripple, that reduce productivity and increase stress, varies by regional and cross-regional contexts. Infectious diseases include those associated with water and insects that breed in water (e.g., malaria), gastrointestinal infections, various types of parasitism, zoonoses, etc. These can be measured by public health and veterinary scientists to indicate secular trends of increase in prevalence and severity, or decreasing incidence in association with environmental improvements and control measures. Changes in the environment, such as desertification, can wipe out disease entities by breaking the means of transmission, or can (as in pools and wells) serve as foci for maintaining transmission and spread of diseases. Disease is also a social fact. Morbidity and mortality are indicators of human ecological well-being. Obviously, loss of water resources due to desertification is the ultimate in loss of viability for agricultural production and human survival potential. Death (mortality) is the strongest kind of indicator, because it is a hard end. Extinction of species or a community is an ultimate indicator of environmental destruction.

Other kinds of sciences involved in environmental monitoring include the food consumption and nutritional sciences. Measures of plant productivity, animal growth rates, and human nutritional well-being or deficiencies can also be interpreted as social indicators. Protein-calorie deficits, especially for vulnerable members of human groups, such as pregnant and lactating women, infants and young children, the aged, and the adult labor force represent measures that can be correlated closely with income levels, educational levels, and occupational activities in rural areas. Changes in the consumption levels of basic food staples by a rural population, or a shift from one essential foodstuff to other sources of nourishment can be social and cultural indicators of an environmental alteration.

An example of food substitution: When millet-eaters in North Kordofan switch to consuming more sorghum than millet, it can mean that environmental desertification has limited millet yields, or that people have moved onto different soil types which produce better yields of sorghum. Millet may become a cash crop due to its higher price at market and more land can become desertified by reckless cultivation of sandy soils. The economics of substituting consumption has profound consequences. Also, during the hunger periods of the year, when malnutrition is a major impediment to production, poverty can be exacerbated by low energy levels and lower capacity to grow crops.

Another example, the propensity of nomadic and settled nomads to drink ruminant milks, an excellent nutrient source, can be monitored for environmental impacts (as suggested by Dr. Johnson for goat milk). Milk yields change as environmental grazing, browsing and livestock health conditions change. Desertification can remove this valuable source of food and destroy a cultural preference on a seasonal or longer-term basis. Sustained milk yields from improved use of agricultural by-products and natural grazing and browsing plant communities can prevent desertification.

Plant diseases and parasites that constrain production may also be utilized as Social Indicators of environmental stress. Here we enter into the realm of ethno-science and folk wisdom as an adjunct to the technical sciences. They are indicators of agricultural efficiency among traditional producers as environmental conditions alter over time. An example from the Nuba Mountains will give the flavor of this approach. Striga (buda) a grain-parasitizing plant, and covered smut (burnuk) a grain fungus both have yield-reducing effects on traditional seed grains essential to sustain life and produce income. Many traditional farmers engage in a form of bush fallow cultivation. A farmer abandons a field when he thinks the soil is exhausted; he opens new fields by cutting and burning trees, or using the hariqa (grass burning) method. For short-term savings the hariqa method is adaptive; but it is wasteful of organic residues and does not make for sustained and increasing crop yields or enhanced fertility of the soil.

One of the folk indicators of worn-out soil is the excessive presence of striga infestation in sorghum or millet fields. Farmers put land in fallow when they find this parasitic plant increasing too much. However, there is no known causal relation between soil fertility decline and the presence of striga. Striga has its own rate of increase associated with repeated sowing of a single crop over a period of years. But, the farmer sees it pragmatically. Fertility decline (due to non-rotation of appropriate crops) seems to be due to the appearance of more striga from his perspective. Hence, (through guilt by association) striga-infested fields are abandoned to bush fallow and new plots are cleared. The message to be learned from this folk indicator is that we scientists have something to learn from the traditional farmers. They can be encouraged to change their cultivation practices to overcome constraints that limit sustained yields, if we understand their perceptions.

Macro, Intermediate and Micro Indicators:

I propose that we divide the Social Indicators that could be used to monitor environmental change into three different levels, labelled the Macro-Level, the Intermediate Level, and the Micro-Level. This classification helps to identify the articulation points for interdisciplinary integration of monitoring indicators, such as, (1) Techno-Science Indicators at a broad spatial and chronological depth level; (2) Regional Indicators at a human ecological level; and (3) Ethnological Indicators of human behavior at local and group-specific levels.

The Macro-Level indicators cover the socio-economic patterns of the nation, and are based on political geography and large-scale weather patterns. They deal with wide spaces, masses of people and lengthy historical processes. In fact,

the transformation of total production systems of cultivation, herding and industry may be related to major environmental shifts such as complete desertification or major climatic change associated with mass population displacement, or invasion, and large-scale ethnic, linguistic and religious take-overs, as well as the development of nation-states and political aggregations. Historical forces can also be used as macro-indicators of periods up to a century in time through measures such as migratory drift by nomadic groupings into new territories in response to desertification (as suggested by Dr. Samani for the Hawazma and Kabbabish nomads of Kordofan). Historical factors are behind the colonization of cultivable plains over time, and the gradual expansion of mechanized farming technologies to hard-to-cultivate soils such as cracking clays. Some of these processes are spontaneous, such as the settlement of nomads; others are part of government-sponsored policies like mechanized cash-cropping. We must also take note of cyclical climatic fluctuations in rainfall over time. Similarly, there is a cyclical process that can serve as a Social Indicator of environmental conditions: the gradual "nomadization" of settled communities in Western Sudan and Sedentarization of nomadic groups which may go on at different measurable rates.

While environmental events on the Macro-scale can be a result of natural as well as socially-induced desertification, the Intermediate Level of environmental indicators is more causally connected to institutional or infra-structural activities by government and economic enterprises within society. Intermediate indicators are regional measures over medium-term periods of time in most cases. They are linked to specific governmental policies and interventions that deliberately alter the environment for specialized production or communication purposes. We have heard other speakers talk of water-yards that lead to patches of desertification, or mechanized shifting cultivation that mines the soil and destroys vegetation cover leading to erosion. These, too, can be viewed as social indicators, much as the suggestion that the number of tractors per unit of arable land, or per unit of population can be described as an indicator of environmental deterioration in a fragile ecosystem, like Algeria.

On the other hand, government policies and regulations can also serve to control desertification, manage natural and agricultural resources and husband soil fertility, thus enhancing sustained yield potential. This kind of environmental manipulation can mitigate the adverse effects of man-made desertification and form a control mechanism for thwarting the vicious cycle (involving fluctuations in rainfall over time) of abuses of the land that lead to accelerated deterioration. Here, as other speakers have suggested, an element of government planning and implementation is needed. This implies a sense of public awareness through education and understanding of the impacts on the environment. Mobilization of a national regional and local political will is needed to control losses. Otherwise, a destructive, spillover effect of temporary gains in production comes at the expense of wider social (and economic) costs, i.e., loss of resources such as forests, grasslands, agricultural soils, and water; i.e., renewable, but transient resources that require good management.

Leading and Lagging Indicators:

In this paper, I argue that Intermediate-Level Social Indicators of government institutional acts, policies and the like, are often leading indicators of incipient environmental change, due to man-made causes, which can have local, regional and even national implications.

Now, I return to the Micro-Level, or study of the local-level of rural communities. Here, social and cultural lagging indicators abound. They are studied and restudied over time by sociologists, anthropologists, ethnologists and other social scientists, historians, geographers and others, and ultimately by archaeologists (after the fact!). Social structures and cultures have been found to respond to environmental change; they are not static. Organization by communities to exploit their environment allows adaptation to the stresses and trends in that environment. But, frequently, the adaptation is not beneficial. Group-specific adaptations are often small-scale in nature and involve social coping strategies. They happen after environmental change has begun, and then enter into a feedback relationship with the environmental change process, sometimes accelerating it, sometimes retarding it.

Classic examples from which indicators can be derived include demographic indicator variables that are stochastic processes, based on households aggregated into populations. Thus, for example, the settlement of nomadic groups that were formerly in balance with their environment through control of human and animal population pressures, is often associated with increased fertility rates, decreased mortality and a human population explosion that puts added pressure on environmental resources around settlement areas. Secondly, livestock numbers are often increased by settlement. Sedentary people invest in ruminant animals such as cattle and sheep, and turn them over to the remaining nomads to transhume during the rainy season. This increases overgrazing and contributes to environmental deterioration of the range in much of the savannah belt, as evidence from Kordofan and Darfur regions would suggest.

This example reminds one of the theory of the "Tragedy of the Commons." Each herder finds it in his marginal productive interest to add livestock units to the collective grazing lands. Meanwhile, for the society and ecosystem as a whole, the result is a net loss and permanent environmental deterioration. Traditional values and control mechanisms are eroded by social changes; environmental management declines; agriculture falls out of balance with the land. Social indicators can show changes in social control mechanisms involving traditional structures such as tribe, lineage or clan groups. As they are replaced by bureaucratic, state structures and centralized or decentralized administrative agencies, these social indicators can be used to monitor likely environmental impacts.

Social Indicator profiles, combined with Intermediate Level of interdisciplinary measures, can serve to provide both Leading and Lagging correlated indices of environmental change to cross-check and verify individual indicators against others. This can become a national monitoring system, a method for deriving

explanations of the causes and consequences of change and a means for intervening to perform mid-course corrections and institute policies aimed at mitigating adverse trends and upgrading and environment.

The approach in WSARP involves use of published studies in the literature and adding our own conclusions to those taken "off the shelf" of accumulated knowledge of Sudan's environment. Our goal is to make a contribution to the needs of Western Sudan target groups while preserving environmental balance to best advantage. Although our approach is regionally and ecologically bounded, I hope that the concept of adapting leading and lagging measures into a combined index will also be applicable to the task of constructing a national set of comparative and comparable indicators. Effective application of monitoring across disciplines and sensing systems may suit the current and future needs of development in Sudan.

Contribution to BUHOTH PAPER, Natural Resources Column, Kadugli Station, ARC
by Dr. Joel Mathless Teitelbaum, Social Scientist/Kadugli

Item- "Settlement and its advantages and disadvantages (if any)
for the future of human life and animal wealth; given the
existing natural resources and prevailing conditions (in
South Kordofan).

Article -

The historical process of settlement in South Kordofan province over the past
half century has taken two major forms:

- (1) Sedentarization of nomads. This has occurred mainly among trans-
humant Baggara tribes of cattle raisers who established settlements
as farmers on sandy areas of the plains, or moved to market towns and
villages.
- (2) Downhill Migration from peaks of various Nuba mountains by various
tribes of the so-called Nuba people. They resettled on the mountain
footslopes and colonized the cracking clay plains.

Today the majority of the rural population of South Kordofan Province is
settled nearly year-round. The 1983 Census should give us more accurate
information on the degree of settlement throughout Western Sudan and the
Kordofan region. This data will assist agricultural researchers, such as
WSARP, in devising needed improvements in crop and livestock production. Also,
government agencies will be able to plan necessary human and agricultural
services for settled people. Natural resources and their proper use are a key
factor enhancing or impeding settlement and agricultural production. For
example, the availability of fertile soils, nutritious forages, rainfall and
dry season water supplies encourages settlement. Also, infrastructure and
prevailing services by government have attracted people to settled farming,
including the creation of mechanized farms, building of roads, establishment of
market centers, and establishment of law and order and various human services
by government agencies.

But, nowadays, some people are leaving mechanized schemes, moving out of
villages and towns, and using roads for emigration or nomadic transhumance, as
they see fewer advantages to being permanently settled than before. Animal
wealth in South Kordofan is distributed in reverse proportion to the degree of
settlement. Transhumant nomads, such as the Baggara, own the largest numbers
of cattle and sheep. They move north to the Qoz soils of North Kordofan in the
rainy season as the cows cannot stand the flies and mud on the southern
cracking clays. In some cases, the disadvantages of settled farming outweigh
the advantages. Natural resources around settlements can be ruined by defor-
estation, burning of rangelands, depletion of soil fertility, and decline in
water resources as population grows. Fewer livestock can be kept near settled
communities than by nomads.

There are also disadvantages to excessive nomadism, including seasonal overgrazing in areas such as North Kordofan Qoz soils leading to erosion, and underutilization of the abundant grasses of the cracking clay areas during the rainy season; and conflicts between nomad cattle owners and settled farmers, due to crop destruction by livestock and competition for limited irrigation and livestock watering sources during the dry season. Also, it is more difficult for government agencies to provide human and agricultural services to transient nomadic groups compared to settled populations.

But, we must take note of the fact that since Independence in the 1950s, there has been increasing "nomadization," i.e. settled people becoming transhumants in Southern Kordofan and other parts of Western Sudan. These new nomads choose to emphasize animal wealth production and evade some of the risks and problems felt by settlers, including: years of poor crops due to low rainfall; low yields due to plant diseases and plant pests; decreased soil fertility, scarcity of water supply and increased rates of disease due to inadequate sanitation; also decline in road maintenance, extension services, health services and educational facilities. Lack of availability of secure land tenure, inadequate marketing facilities, and hard-to-get credit for investment in crop production, as well as labor bottlenecks (especially during weeding and harvest peak periods) also causes losses to farmers. Meanwhile, livestock have been increasing in value and are mobile stores of wealth that give a better return than money in the bank.

In other words, the process of long-term settlement provides real advantages that can improve agricultural production and the standard of living of the rural people. But, unless settlement is well planned, natural resources are conserved, and essential human needs are met with government services, people tend to leave the farms of Southern Kordofan. They may become migrants in the rural exodus to big cities like Khartoum or to irrigated schemes along the Nile. They may turn back to nomadism or gathering, and may become transient agricultural laborers. Under these conditions, settled villages tend to decline in population and productivity, human life becomes impoverished and natural resources are poorly managed. The point is that people settle down to farming when they see advantages for their families and can gain income, but they become unsettled when the disadvantages of a rural sedentary way of life outweigh the advantages under prevailing conditions.

APPENDIX II

PROJECT SUMMARY REPORT

Title: Wood Fuel Gathering and Land Clearing by Transhumant Women at the WSARP Farm

Principal Investigator: Barbara Michael, Associate-in-Research Social Science

Co-Investigators: Dr. Joe Gingrich, Agronomy
Dr. Joel Teitelbaum, Social Science

Time Period: January 22, 23, 24, 1983

Brief Summary of Project: by Barbara Michael

The idea for this project was conceived during a discussion about land clearing at the WSARP research farm at a weekly staff meeting. Dr. Gingrich reported that the work of cutting trees to clear land for agronomy plots had been completed and that the next step was to burn them. It occurred to me that an alternative to burning the trees on the farm would be to find some means of providing them to women who need firewood. This alternative use of the cleared trees seemed to have several potential advantages, both to one of our target groups and to the project. First, trees are a scarce resource and so to make them available for firewood would be both ecologically and conservationally sound. Secondly, since women expend a great deal of labor in gathering firewood, having access to already felled trees would significantly save labor. Thirdly, the WSARP is committed to interventions which will aid our target groups. Supplying firewood, a by-product of land clearing, would be such a short-term intervention which could have a variety of spin-offs. The primary spin-off would be the demonstration of the willingness of the project to benefit the target groups with whom we are working and to cement relationships which are necessary in order to facilitate other project work. In addition, this project had the possibility of increasing our information base in several important areas: (1) The allocation of labor; (2) The degree and type of cooperation in a communal project; (3) An understanding of leadership roles; (4) The relative value of certain types of wood as reflected in gathering choices; (5) The degree of cooperation or non-cooperation between fariqs (camps). The project also tested the assertion that transhumant women will not fell large trees.

Procedures (Activities) Carried Out:

Approval for the project was given by Mr. Kanani, Kadugli Station Director, on the condition that Dr. Gingrich and I evaluate the suitability of the wood for fuel. After looking at the felled trees, we decided the wood was suitable. The Station Director also agreed to use of project vehicles to transport the women to the farm and a lorry to haul the wood to the fariqs. There was some urgency to complete the project so that the hired wood cutters could finish any necessary clearing after the women gathered fuel wood.

The two fariqs residing in dry season camps on the seraf near the research station are segments of the Oulad Nuba and the Dar Sholongo lineages tribes of the Baggara Hawazma tribe. Dr. Teitelbaum and I decided to present the wood-gathering idea to the fariqs, using two different approaches. These were based both on how we had been working with the fariqs and also to see how the approach would affect the organization and outcome of the project. I had been working closely with the women of the Oulad Nuba fariq, so I chose to present the idea to the women, through the sheikh's sister, who seems to have leadership status. Since neither Dr. Teitelbaum nor I had yet had much communication with women of the Dar Sholongo fariq, we decided to put the proposal to the sheikh and the other men.

The first two days of this project were spent organizing in the fariqs and on the Station. The third day we carried out the wood gathering. On that day we transported the women in two pickup trucks to the WSARP farm, where they spent about four hours gathering wood. At the end of that time, a Station lorry came to the farm to haul the wood to the fariqs.

Results:

In our initial discussions with the Ouled Nuba women they raised several points which affected the planning and carrying out of the project. The women wanted to know what kind of wood was available and whether or not it was green. They wanted to go early in the morning, but after they or their daughters had returned from selling milk; around 7:00 a.m. They wanted to return to the fariq by early afternoon (1:00-2:00 p.m.) in order to prepare the main meal of the day. They agreed to having women from the two fariqs along, but they insisted that the wood gathered by each fariq be kept separate.

There was no problem complying with their time request. In order to keep each fariq's wood separated, I bought two colors of plastic rope from the souk to tie up bundles of wood; one color for each fariq.

The women from each fariq travelled to the farm in separate vehicles. There were 12 to 14 women in each group. There were several age-groupings in each group. However, there were only married women from the Ouled Nuba, while there were several adolescent girls in the Dar Sholongo group. The Dar Sholongo group also included the two wives of the sheikh, which resulted in a small leadership struggle; particularly in the evaluation of the quality of wood available, and the formation of work groups.

The felled trees had been gathered into small piles which included both dry and somewhat green wood. Some of the Dar Sholongo women were dissatisfied with that wood and decided to gather wood they considered sufficiently dry from an area adjacent to the WSARP farm. The Ouled Nuba women dispersed almost immediately over a wide area and began collecting. By tacit agreement, the women maintained a spatial separation by fariq. In general, the women worked by themselves, and in cases where they worked in close proximity, they worked and kept their piles of wood independently. In general, the older women were more focused on the task, spending little time in deciding how to go about the task or in chatting. The adolescent girls soon stopped working and spent most of their time drinking tea. No one admonished them to continue working.

The area in which trees had been felled was about 55 feddans, and had been covered with a rather dense growth, primarily of Acacia seyal, resulting in a large total amount of available wood. However, rather than collecting as much wood as possible, both dry and green, with the idea of storing the green wood until it was dry, only dry wood was selected. Clearly, dry, immediately burnable wood was preferred. It is not possible to say from this short experiment whether the total amount of wood collected would have been greater had collecting been indiscriminate. Certainly, the same amount of wood would have been collected with less labor, in terms of distance travelled in collecting and energy expended carrying wood to where the lorry picked it up. At the end of the four hours, each woman had collected enough wood to provide fuel needs for approximately five days. That amount is equivalent to what would typically be cut, gathered, and transported in three one-day excursions. In addition, several women cut or gathered large poles suitable for building. This was our first direct observation indicating that women do fell large trees. (I have since observed women girdling and burning the base of a large tree in order to fell it.)

When the lorry came to haul the wood, the women carefully supervised the loading, making sure that the wood from each fariq was kept separate, even though the bundles had been color-coded with the plastic rope. At their fariqs each woman later claimed her own bundles of wood, seemingly without difficulty.

Conclusions:

One conclusion we reached as the result of this project is that transhumant women can and do fell large trees. This perhaps has some implications for interventions in bush control, for example.

Project credibility with these two fariqs increased considerably as a result of this project. Both the women and the men continue to talk about how we helped the women collect wood. It seems reasonable to believe that this project helped to facilitate further work with these fariqs for example, in the livestock supplementary feeding experiment. Word of the wood gathering soon reached their sedentary relatives in nearby villages, and the men requested that we take their women to collect wood. We also were asked to aid in transporting grass for housebuilding. Even though we have been unable to help in those specific requests, our overall reputation has been enhanced.

APPENDIX III

RELATIONSHIPS OF PRODUCTION AND CONSUMPTION AMONG TRANSHUMANTS IN THE WESTERN SUDAN: GENDER AND ROLE AMONG THE BAGGARA OF SOUTH KORDOFAN

Dissertation Proposal

Barbara Michael

Statement of the Theoretical Problem:

The major question to be asked is: What factors contribute to the perpetuation of transhumance among the Baggara of South Kordofan?

Among the Baggara (Cunnison 1966) analysis has identified two operational ideologies: (1) an economic ideology; and (2) a genealogical or kinship ideology. The Baggara economic ideology is focused on the value of cattle management and preference for transhumance through the independent household. The kinship ideology stresses the importance of the partilinal group and of close cousin marriage. An additional aspect of both of these ideologies is male dominance over cattle and women.

The research problem is to explain these interlinked ideologies in terms of actual behavior. Actual behavior includes: (1) the organization of several households into permanent camps for livestock production and crop raising; (2) widespread evidence of bilateral kinship ties which create multiplex links binding several households together; and (3) evidence of relatively autonomous management roles for women in such activities as household management, cattle ownership, milk marketing, and consumer purchases.

My major hypothesis is that these behavioral processes contribute to the perpetuation of transhumance, while allowing flexible movement between sedentarization and nomadization by individual householders in response to situational production strategies and constraints.

Factors to be Investigated:

1. Nomadization and sedentarization - Under which circumstances are these production systems more economically viable?

One of the research goals will be to define the economic system of the Baggara, and to understand why transhumance remains a viable part of it. The research will investigate the process of movement along the continuum of nomadization and sedentarization and the articulation of the various modes of production. It will consider such questions as how and why the decision to nomadize or sedentarize is made (Cisse, 1981); i.e., how do the Baggara arrive at their strategies for survival; what economic production factors does the decision attempt to maximize (capitalist v.s. non-capitalist modes, importance of wage labor, education); what influences the allocation of human resources to the processes of nomadization or sedentarization (Haaland, 1972); how does either strategy affect women and children; and

conversely, how do the productive capacities of women and children contribute to a household's capability to transhumate or its choice to settle into farming or off-farm employment.

2. Gender and role and the sex/age division of labor - In what ways and to what degree is women's labor used productively in the Baggara household?

Research on this topic will consider: (a) women's role in management and agricultural production; (b) social constraints in the definition of gender roles (norms and actual behavior) (Chatty, 1978; Cunnison, 1963; Rogers, 1980); (c) definition of the household; (d) household and family conditions including reproduction, child rearing patterns, health and standard of living (Goody, 1976); (e) women's resources and income sources, including the use and management of ruminant milks and the allocation of household resources (Dahl, 1976); (f) in what ways women have leverage in the social structure (for example, what happens to a divorced or widowed woman; calculation of divorce rates; what sort of property does a divorced or widowed woman maintain control over); (g) the relationship of gender and role to the seasonal cycle, i.e., women's contribution to tendencies for settling or nomadizing and the impact of seasonal migration on women and children; (h) women's status and roles, e.g., in conflict resolution (MacCormack, 1980; Palmer, 1981).

3. The functions of kinship and marriage ties -

Research will focus on how kinship and marriage interactions promote transhumance or settlement along the transhumant/sedentary continuum; the importance of bilateral kinship ties; the relationship of the use of a classificatory kinship terminology to maintenance of the system; and the function and density of multiplex kinship and affinal links within and between household production units, and their constraints on capital accumulation.

4. The advantages of social networks -

Research will attempt to identify social networks which are not necessarily kin-based and to determine how they may or may not overlap with kinship ties. An attempt will be made to understand how social networks facilitate or retard production, strengthen group solidarity, maintain higher nomadization or sedentarization, or allow movement between these two economic modes.

5. Inheritance and redistribution of agricultural resources (intra-and inter-household)

Research will consider how inheritance patterns and socio-economic institutions of redistribution (via gifting, blood money payments, farmland division, circulation of cattle between transhumant and sedentary households, sacrificial rituals, etc.) help to maintain the transhumant system or affect the decision-making of a household to nomadize or sedentarize, and how these customs encourage productive offtake or limit livestock sales (Cunnison, 1960b).

6. Culture space -

Research will investigate the definition and allocation of culture space in terms of gender and role, ethnicity and language, and concepts of public v.s. private in the intergroup context (Lancaster, 1981; Rosaldo, 1974).

Field Data Collection Procedures and Methodology:

Selection of the study sample will be made on the basis of results of reconnaissance visits to transhumant camps in the Southern Kordofan area. Baseline data will be collected from some fifteen transhumant camps totaling up to sixty households. These diagnostic surveys will enable the identification of three households as subjects of intensive case studies. The three case-type are: (1) A transhumant Baggara household which maintains its migratory pattern; (2) A sedentarizing household which has begun to settle out of the transhumant stream and adapt to a more limited movement of herd animals; (3) A formerly settled household which has recently entered the transhumant system and increasingly adopted migratory practices.

Methodologies to be employed or incorporated will include:

1. Demographic studies*
2. Ecological and land-use studies*
3. A household economic inventory (including consumption patterns and material culture)
4. Genealogical studies
5. A panel survey - to provide a longitudinal study of the impact of change*
6. Household case studies
7. Participant-observation which will include movement with a transhumant household through the annual cycle.

*Derived from WSARP interdisciplinary team research

Analysis:

Qualitative features to be analyzed include:

1. Ethnic identity
2. Religious affiliation
3. Material culture
4. Language
5. Customary behavior - prescribed and proscribed

6. Rituals and ceremonies
 7. Description of the transhumant annual/seasonal cycle
- Quantitative variables to be treated statistically include:

1. Demographic composition of households and camps
 - a. Population dynamics
 - b. Age/sex pyramid
2. Herd composition and dynamics
3. Economic assets and socio-economic differentiation
4. Variations in livestock and crop productivity
5. Factors promoting nomadization or sedentarization
6. Network analysis

Anticipated Contribution of Completed Dissertation to Anthropological Literature and Its Application to WSARP Objectives:

Results of the research should contribute to:

1. Advancing anthropological analysis of the public/private domains among pastoral nomads.
2. A better understanding of the processes involved and the factors affecting nomadization and sedentarization.
3. Insight into women's roles and how these roles contribute to the perpetuation or elimination of transhumance among the Baggara.
4. Better understanding the functions of close-cousin marriage in pastoral nomadic systems, and Arab Muslim societies in general.
5. Understanding Baggara cultural adaptation to introduced changes in productive techniques and consumer needs.
6. More complete definition of the transhumant production system in South Kordofan.
7. An assessment of production-enhancing interventions and their successful adoption by transhumants and sedentaries.

APPENDIX IV

1982 FIELDWORK PLAN FOR WSARP SOCIAL SCIENCE RESEARCH BASED AT KADUGLI

Prepared December 7, 1981, by Joel M. Teitelbaum

The primary area focus of research, training and the development of testable production packages in the Western Sudan will be in Kordofan Region, mainly in the southern portion, initially. The focus will be on indigenous pastoralist production systems and changes in them associated with farming practices. The lead social scientist will team up closely with the range scientist and others to study grassland livestock production and potential for increased stable production in the grasslands, with special attention devoted to the sociology of nomadic transhumant households and herding groups that graze cattle, sheep and goats and later camels (at El Fasher).

The basic research questions are addressed to current production systems for trek nomads and semi-sedentary transhumants (semi-nomads). The purpose is to understand the key societal and socio-cultural variables that contribute to or constrain the achievement of a more optimal mix of producer inputs and environmental conditions so as to raise the carrying capacity of the natural ranges while preventing their degradation and move toward a year-round utilization of resources. Research will be done to a lesser extent on sedentary farmers in the pastoral areas to fit all agricultural producers and consumers into the production systems framework and to understand nomad-farmer interactions that may benefit or adversely affect livestock production; with the aim of achieving greater integration and stable utilization of by-products of each mode of land exploitation.

I. SPECIFIC RESEARCH ISSUES FOR SOCIAL SCIENCE WORKPLAN (Suggested ways to make interdisciplinary teams in the project effort--See Dwyer Report on Range Research at the Kadugli Station, October 26-November 16, 1981)

A. Herder/Farmer Census:

The social scientist(s) will make field observations and describe the demographic structures and social composition of nomadic and transhumant livestock owners and operators in areas selected with the range scientist for vegetative mapping and with the range and livestock specialists for herd structure and composition studies. The social scientists will assist in the livestock census, placing their emphasis on the ownership and management rights in specific species by age and sex in the herds by household and within households.

B. Trek Routes and Migratory Orbits and Transhumance Cycles:

Together with the range and animal scientists, the social scientist(s) will make on-site and interview investigations of the mobility of pastoralist livestock herds across the annual

seasonal cycle (north-south axis); and indigenous herding group rationales and choices of grazing sites and water resources during movements.

Patterns of migratory drift by nomads over longer periods of time, and sedentarization patterns by households; reasons for some households choosing to "settle out" or shift from trek nomadism to semi-nomadic transhumance (or vice-versa) over generations or periods of weather variation.

Land and water tenure rights and holdings by nomadic households and tribal groupings, as well as individual ownership of private agricultural lands and access to "public" or collective lands. Other agricultural or naturally harvested products for which nomads have rights or usufruct (forestry products, wildlife, salt deposits, etc.).

- C. Social science research efforts will also focus on key issues in traditional pastoralism that need understanding of cultural practices in order to make environmental improvements possible. These include the existing practices of range management by nomads, and herder viewpoints vis a vis range science findings:
1. The perception of carrying capacity of the vegetation in relation to herd size (seasonally) and ways of adjusting the intensity of grazing or timing of grazing or species-specific grazing. Problems encountered by herders in achieving control over excessive or over-stocked grazing patterns.
 2. Perceptions of herd managers as to their livestock preferences for certain types of vegetation, and the feed (nutrition) value of these forages for the well-being of the herd.
 3. Burning of grazing area vegetative cover by pastoralists and farmers and their perception of its usefulness and timing in relation to herd grazing needs or agricultural uses. Problems encountered in control of burned areas, in frequency of burning and who burns the cover.
 4. The "biting fly and mud" issue suggests a need for social science investigation of the nomad household and group rationales for their herd treks and timing by season along the north-south axis, and transhumants' choices of grazing for their herds during the annual cycle, also. This research also looks at traditional herder group and individual strategies for coping with rainfall variability and using the mobility of the herds to survive during the dry seasons. Both practical and "mythical" reasons for movements will be researched, including questions concerning wet-season insect and/or disease vector problems for the

human groups as well as their livestock, and social and economic reasons for return to specific villages or campsites at the ends of the movement cycle, or along the trek routes.

5. Sources of conflict over land, grazing area, water resources and livestock deprivations of crops between nomadic groups and sedentary farmer households or villages, and among competing or criss-crossing nomadic herding units. This research calls for study of the perceived rights of these resources, and the methods and political-judicial institutions available to resolve conflicts, seek redress, and control violent outbreaks. Also, it is valuable in determining the access of groups to lands improved for grazing utilization on a year-round basis.
6. The issue of the interdependency (degree and type of integration) between livestock producers and farmers along their routes of passage forms the other side of the coin of pastoralist-farmer conflicts, and is key to improving the production system. Social scientists on the team will investigate the exchange of livestock, livestock products and by-products and labor by pastoralists for food crops, water and other resources (including labor and cash) with settled people, especially food grains such as sorghum and millet. The social structures and economic institutions involved in this localized and regional exchange relationship will be examined as potential benefits or constraints to improving productivity.
7. The issue of labor bottlenecks and the intensity of labor supply used in pastoral livestock production in comparison to farming is one that will be key to the determination of herd size and productivity. Social science research will build on the census by watching households via participant-observation methodology to determine traditional and changing practices of labor on herd animals according to sex, age, social and economic status, and other factors (such as migrant or part-time labor). This will relate to range management practices and the skills developed by segments of the herder population concerning livestock husbandry.

The use of livestock for transport by nomads and for traction by sedentary farmers as well as specialized cartage by livestock or equids will be described in relation to labor and energy use, and substitutions of animal for human labor demands.

8. The social scientist(s) will focus on the culturally-sanctioned tribal and household relationship to range animals, and the preferences of various herding groups for specific species or age/sex strata characteristics of the beasts. This form of social investment involving possible

combinations of mystical or religious-ceremonial use of livestock, social exchange, prestige in accumulation, and increasing herd numbers to hedge against environmental uncertainties, will be investigated also in relation to the economic investment strategies used by various types of herder households, and the price-structures and market access problems they encounter. Much of this latter study of household livestock economics should be done in collaboration with project economists. It also relates to the retention of older male stock in excess numbers on the range, hence links into the herd structure and composition census in collaboration with range and livestock scientists in the project.

Social scientists will also interview nomadic and transhumant household members to determine their perception of the relative productivity of cattle, sheep and goat species and breeds of livestock, and their resistance to disease and hardiness under the nomadic regime. This folk wisdom will be correlated with animal science studies of the milk, meat and reproductive capacity of the traditional livestock, and their potential for specialization in milk production, meat production, and other by-products for consumption for sale.

9. The issue of calf versus human consumption of animal milks is a complex one requiring close cooperative research between social scientists and animal scientists in the project. The issue may be summed up as a potential for conflict between calf nutrition and survival and human nutrition and consumption or sale of dairy products. This will be studied by means of close observation of the milk production and distribution process, and controls on the uses of dam milks within the household, by age, sex, and status. Special attention will be paid to the use of animal milks for young children. Also, the preferences and sequencing in human use of animal milks by season and species will be determined. With potential for increased yield as dairying practices change, the substitution of goat milk for cow or sheep milk may increase herd productivity overall, if achieved in a culturally and nutritionally acceptable manner.

II. INTEGRATED CROP-LIVESTOCK PRODUCTION ON CRACKING CLAYS

Other related activities of the social scientist in 1982 include:

- A. Team effort with other scientists to define constraints and opportunities for research in cropping systems.
- B. Participation in periodic project meetings to report progress and plan activities.

- C. Prepare reports as required for project, AID, World Bank and GOS requirements. The annual report is due in Pullman by September 1, 1982, with quarterly reports prepared in Khartoum for the World Bank.

APPENDIX V

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