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JESS PHASE II REPORT AND  
PHASE III WORK PLAN

JESS Report No. 30

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## ABBREVIATIONS AND ACRONYMS

AHT	Agrar- und Hydrotechnik, GmbH
ARD	Associates in Rural Development, Inc.
CRDP	Central Rangelands Development Project
EC	electrical conductivity
ELC	Electroconsult
FAO	Food and Agriculture Organization of the United Nations
GSDR	Government of the Somali Democratic Republic
HFA	Halcrow Fox Associates
JESS	Jubba Environmental and Socioeconomic Studies
JuDAS	Jubba Development Analytical Studies
LMH	Livestock Marketing and Health
LTC	Land Tenure Center
MARS	marketing survey
MFMR	Ministry of Fish and Marine Resources
MJVD	Ministry of Jubba Valley Development (now MNPJVD)
MNPJVD	Ministry of National Planning and Jubba Valley Development
MoH	Ministry of Health
NAS	National Academy of Sciences
NRC	National Refugee Commission
NUS	National University of Somalia
PHC	primary health center
PVO	private voluntary organization
REDSO	Regional Economic Development Services Office
RHU	Rural Health Unit
RMR	Resource Management and Research Ltd.
SEBS	socioeconomic baseline studies
Somac	Somali Academy of Science
TDS	total dissolved solids
TEBS	terrestrial ecology baseline studies
UNHCR	United Nations High Commissioner for Refugees
USAID	U.S. Agency for International Development
USBR	U.S. Bureau of Reclamation
WBS	women's baseline survey
WHO	World Health Organization

## PREFACE

Jubba Environmental and Socioeconomic Studies (JESS) is part of the Jubba Development Analytical Studies (JuDAS) Project, which is being implemented in southern Somalia by the U.S. Agency for International Development (USAID) and Ministry of National Planning and Jubba Valley Development (MNPJVD) of the Government of the Somali Democratic Republic (GSDR). Associates in Rural Development, Inc. (ARD), of Burlington, Vermont, is providing technical assistance and project management for JESS under a USAID contract (number AFR-0134-C-00-5047-00). The JuDAS Project also includes a soils and land use classification project, that was implemented and completed by the U.S. Bureau of Reclamation (BuREC), and a long-term training component administered by AID. In addition, the Board on Science and Technology for International Development (BOSTID) of the National Academy of Sciences (NAS) provides advisory services to AID and MNPJVD under the JuDAS Project.

The JuDAS Project has two major purposes:

- to gather necessary information on soils/land use and socioeconomic and environmental factors to be incorporated into a master planning process for Jubba Valley development; and
- to provide MNPJVD with technical support and training.

To assist with Jubba Valley development, JESS is supplying the results of its socioeconomic and environmental studies to a master planning team in MNPJVD from the German Agency for Technical Cooperation (GTZ) and Agrar- und HydroTechnik, GmbH (AHT). JESS is also providing practical, informal training for its Somali counterparts and serving in an advisory capacity to AID and MJVD on long-term training.

This report reviews JESS Phase II activities in field data collection between 1 April 1986 and 31 March 1988, in compliance with AID reporting regulations. It also presents the work plan for Phase III of JESS, including activities involved in the analysis of field data, report preparation, and project management and administration.

As of 31 March 1988, the JESS technical assistance team included:

- Dr. Robert "Gus" Tillman--team leader;
- Dr. Kathryn Craven--socioeconomics;
- Dr. Ian Deshmukh--ecology, vegetation and wildlife;
- Dr. James Merryman--anthropology;
- Dr. Nancy Merryman--administrative coordination and anthropology; and
- Ms. Marie Tillman--data center coordination.

## I. EXECUTIVE SUMMARY

This report reviews the activities and accomplishments during 24 months of field data collection during JESS Phase II, from April 1986 to March 1988. The report also comprises a summary work plan for the analysis and interpretation of collected data during JESS Phase III (April to December 1988) and publication of the JESS final report.

### A. Phase II Accomplishments

JESS accomplished nearly all of its objectives planned for Phase II relatively on schedule. The Phase II work plan was necessarily amended on several occasions based on the evolution and focus of master planning activities and changing needs for baseline information. These changes resulted in the reduction or deletion of certain research aspects of the project, with the addition or expansion of others.

Field data collection for long-term baseline studies was completed at levels far surpassing original expectations. Socioeconomic baseline data collection yielded 1,057 completed household questionnaires and 276 women's issues-specific questionnaires, data from which were being entered into JESS computers with ever-increasing precision by trained Somali staff. One full year of data was collected on marketing and price structures of agricultural commodities from four local and regional markets in the Jubba Valley. Species identification, measurements and classification were finished on 90 vegetation monitoring sites established in relationship to Jubba River floodplain and river-dependent zones. Field methods for each long-term baseline study and methods for data analyses are described in this report.

Several major remote-sensing activities were completed during Phase II: run-of-the-river stereo pairs, six aerial censuses of the floodplain and river-dependent zones, and aerial photographs of selected towns and sites for vegetation mapping. Land use maps of the river-dependent zone were prepared on the basis of aerial photos from 1960 and 1987.

Three interim reports were produced during the period. These synthesize information about potential impacts of construction and operation of the Baardheere Dam, and highlight issues concerning dam design for the proposed project.

Several interim reports were distributed concerning effects of dam and valley development on aspects of public health, including community water supplies, sanitation and disease vectors. Two epidemiological surveys on the incidence of

bilharzia and malaria were carried out in the Lower Jubba Valley. The malaria survey showed an infection rate of 20.7 percent of the total surveyed. Bilharzia, on the other hand, proved to be a more serious problem than anticipated, with an overall infection rate of 75 percent of the sampled population.

One full year of water quality sampling in the Jubba River, irrigation drains, wells and dhesheegs was performed for JESS by the National University of Somalia (NUS). Field sampling included parameters of temperature, pH, electrical conductivity, turbidity and flow measurements. Samples were taken to the university where laboratory analyses were made for numerous chemical parameters, including chlorides, total dissolved solids, suspended solids and ionic balance.

A study on hydrology, sedimentation and river scour found that the expected amount of inflow to the reservoir was overly optimistic by 15 percent. At the same time, after the dam is completed, little problem is anticipated with downstream river scour.

Two fisheries consultancies produced a wealth of data on species of fish in the Jubba River and the river's capacity for fisheries. In addition, two Kenyan scientists conducted a brief limnological survey of the river. They noted low diversity in the populations of phytoplankton, zooplankton, benthic organisms and macrophytes. However, because of irregular flooding conditions, these results may not be representative.

Investigations of forest resources and related utilization activities in the Jubba Valley found that these resources are not being overexploited at present and are in fairly healthy condition. There is a noticeable lack of tall trees, which indicates a scarcity of sawtimber. A report concerning conservation of Jubba Valley forests was produced.

Two botanical surveys in support of the JESS terrestrial ecology baseline studies resulted in multiple specimen collections (265 during the first survey, 119 during the second) from the Jubba Valley. Ethnobotanical information on selected species was elicited from local residents.

A collaborative effort with University College of London resulted in a biological survey in the Middle Jubba Valley. This study, combined with data from aerial censuses, yields a fair account of wildlife abundance in the project area. Two ornithological surveys of Palearctic migratory birds recorded a total of 313 species, including 13 not previously recorded in Somalia. While the Jubba Valley is an important site for water birds, it was not found to be an important migratory passageway for Palearctic species.

A broad survey of pastoralists, including two aerial reconnaissances and five weeks of on-ground surveys and interviews, noted migration patterns tend north to south in the Jubba Valley during dry seasons, returning south to north as rains appear, and rarely crossing the river. Afmadow is the important rangeland for Gedo herders, while Bay Region herders favor the Shabeelle swamps during the Jiilaal. Several government interventions (tubewells, water-storage ponds and abolition of tribal boundaries) have brought about recent changes in migration routes.

A field survey of the Jubba Valley was carried out to assess land tenure issues. Preliminary findings indicate there are few current problems, but changes could occur rapidly as a result of the accelerated development that may take place after dam construction.

A large consulting team traveled by camel caravan to execute a limited-sample cultural heritage survey of the eventual inundation zone. Some 699 sites were investigated, including camps, scatters, cairns and caves displaying unusual rock art.

A JESS remote-sensing consultant began work on the development of a geographic information system-based study of the Jubba's upper watershed in the Ethiopian highlands. The study is attempting construction of a computerized model to predict flow levels at Luuq, the entrance to the future Baardheere Reservoir, based on precipitation quantities and distribution in the upper watershed, as modified by soils and vegetation conditions.

Initial investigations were carried out concerning establishment of a long-term environmental and socioeconomic monitoring system for Jubba Valley development. Monitoring capabilities and experience in Somalia were reviewed, and tentative schemes and themes were proposed in order to take full advantage of baseline studies being produced through JESS and Jubba Valley development master planning efforts.

Emphasis is placed in this report on the importance of collaboration with MNPJVD and the GTZ/AHT master planning team in carrying out only those investigations deemed vital in leading to successful implementation of the Baardheere Dam project and subsequent Jubba Valley development. JESS has maintained continuous liaisons with numerous organizations and personnel from other development entities, within and outside Somalia, in an effort to avoid duplication of research efforts and aid in the overall MNPJVD effort.

## B. Phase III Work Plan

The Phase III work plan focuses on the steps leading to publication of the JESS final report. The report will represent the culmination of JESS' three-year, three-phase research efforts.

A separate, stand-alone report will be prepared for each JESS long-term baseline study. The socioeconomic baseline studies will include analyses of the 1,057-case household survey and the 276-case women's baseline survey. The marketing survey will be based on analyses of one year's data collected at four local and regional markets in the valley. A comprehensive report on the terrestrial ecology baseline studies will include analyses of seasonal and flood-related dynamics of vegetation, land use and wildlife populations. Pending reports concerning the results of short-term field investigations carried out before the close of Phase II will be released in final form before May 1988.

The JESS final report will synthesize information from analyses of long-term baseline studies, short-term investigations and other relevant documents into a succinct executive volume. Final reports on long-term baseline studies and short-term investigations will be annexed to this executive volume. All baseline research materials (e.g., data bases, aerial photographs, field maps) will be reproduced in limited quantities and transferred to USAID and MNPJVD for future uses, including long-term monitoring.

Finally, details are presented on plans for finalization and publication of the final report, inventory and transfer of JESS equipment, layoff of JESS local-hire staff, close-out procedures and repatriation of JESS expatriate long-term field staff.

## II. INTRODUCTION

JESS was originally envisioned as a three-year, three-phase project to collect environmental and socioeconomic data in Somalia's Jubba Valley--the site of proposed development of a 75-meter-high hydroelectric dam (see Figure 1). Complementary to construction of the dam, various plans are being prepared for subsequent development of the Middle and Lower Jubba valleys for irrigated agriculture. Numerous environmental and socioeconomic changes will occur with dam construction, reservoir filling, infrastructural enhancement and intensification of agriculture.

GTZ is financing the preparation of a master plan for development of the Jubba Valley. The West German consulting firm AHT is providing technical assistance to MNPJVD to research and prepare the master plan. USAID is financing the Jubba Development Analytical Studies (JuDAS), of which JESS forms an integral part. JESS began in September 1985 and will end in December 1988 with publication of the JESS final report. JESS is organized in three phases as follows:

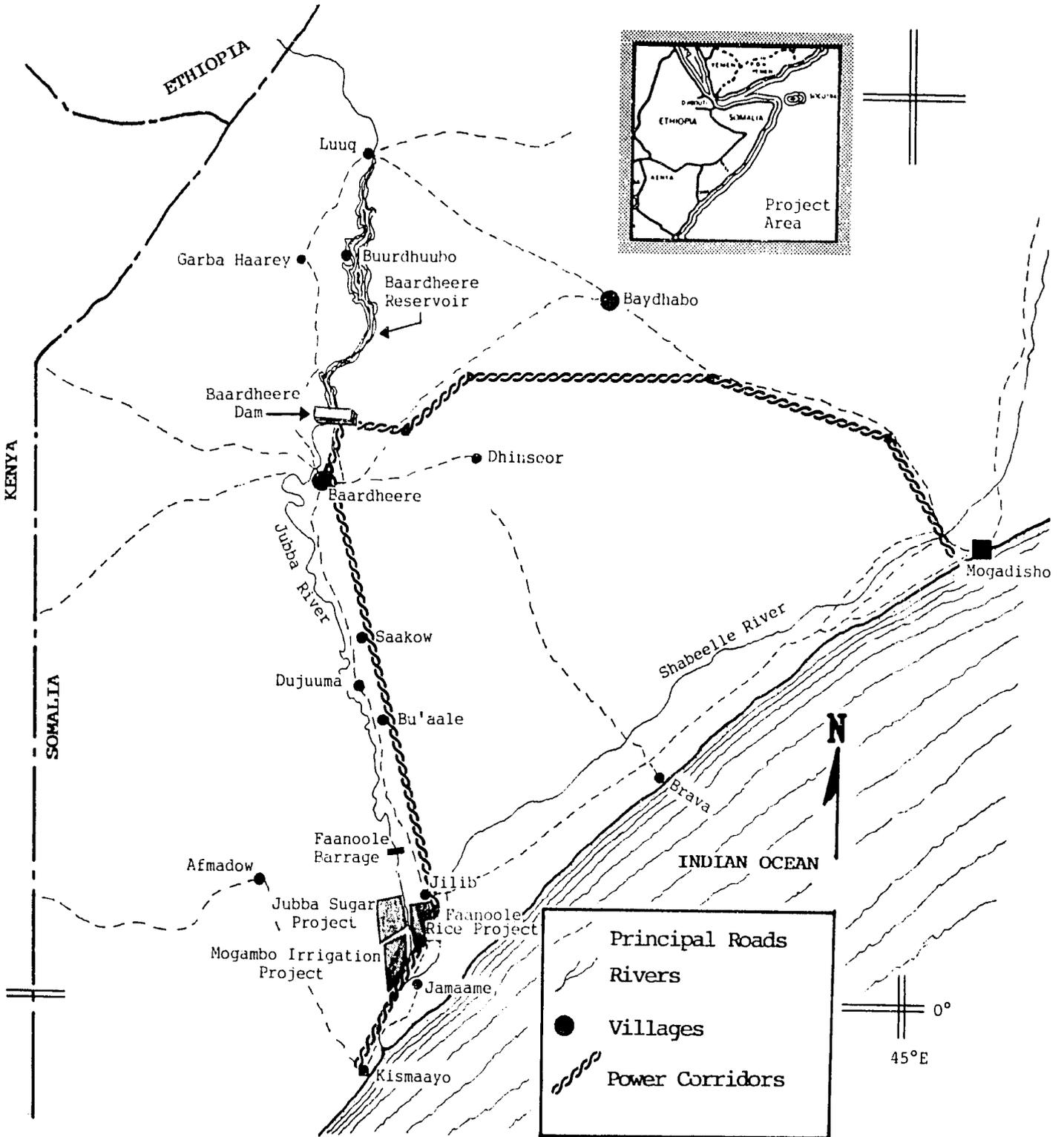
Phase I: A six-month period (September 1985-April 1986) used to review and assemble data from existing literature, studies and ongoing projects in the project area. Based on information gaps and an overview of the project area, JESS prepared a work plan to realize appropriate baseline and problem-specific studies concerning environmental and socioeconomic conditions in Jubba Valley. Activities and accomplishments during the phase are detailed in JESS Report No. 1. (See Appendix B for a complete list of JESS reports.)

Phase II: A 24-month period (April 1986-March 1988) of intensive field data collection, including three longer term baseline studies (socioeconomic, marketing and terrestrial ecology) and more than 25 separate short-term investigations of a variety of socioeconomic and environmental disciplines with relevance to Jubba Valley development.

Phase III: An eight-month period (April-November 1988) of data analysis, synthesis and interpretation of research results. This phase represents the culmination of JESS research efforts and will result in a comprehensive final report concerning pertinent research findings. The report will include recommendations for avoiding or mitigating negative effects of dam construction and operation as well as development of the Jubba Valley.

The present report covers JESS activities and accomplishments during Phase II, from April 1986 until the end of March 1988. Emphasis is given to describing methods of field data collection used for longer term baseline studies--analysis

Figure 1. Area of the Baardheere Dam Project and the Jubba Valley Development



of the data collected is to occur in Phase III. Short-term investigations carried out during Phase II, study methods and principal findings are summarized. The report also presents the JESS Phase III work plan, describing principal activities and outputs to be developed during the project's final eight months.

#### A. Review of Phase II Work Plan

In February and early March 1986 (Phase I), a major effort was made to design the studies proposed in the Phase II work plan. This work was done in Somalia by the JESS long-term field staff, three visiting ARD staff members and five international experts on various aspects of river basin development, in consultation with MJVD (now MNPJVD) personnel, National Academy of Sciences (NAS) scientists, professors from NUS and representatives from numerous Somali organizations.

These activities included interviews and brainstorming sessions as well as on-the-ground visits and reconnaissance flights over the Jubba Valley. The design studies also capitalized on advice and discussions from an NAS workshop held in Somalia in January 1986. Studies were designed using lists of issues drawn from ARD's scope of work, the NAS workshop, experience of ARD staff and consultants, and literature on other river basin assessments, planning efforts and developments elsewhere in Africa and around the world.

Through interviews, in-country research and meetings, ARD identified activities being conducted by other organizations in the Jubba Valley and refined the very long list of issues that had been drawn up originally. Preliminary study designs were prepared, including scope and methodology, human resource requirements and scheduling suggestions. On completion of the preliminary design of Phase II studies, they were transferred to ARD's home office and incorporated into a draft work plan for Phase II. The draft work plan was reviewed at USAID and MNPJVD in Somalia as well as the offices of NAS, ARD and its subcontractors in the United States. The plan was revised and published on 31 July 1986 as JESS Report No. 1.

The Phase II work plan cited the following objectives:

- gathering and presenting data for the Jubba Valley that fit into the process of developing a master plan for valley development;
- establishing a realistic, long-term system for environmental and socioeconomic monitoring;

- preparing river-basin planning and development guidelines and incorporating them into the development planning process; and
- training MNPJVD staff so they can continue to collect and analyze data, and plan and monitor development activities.

The Phase II work plan proposed two broad categories of comprehensive baseline studies (socioeconomic and environmental) directed by ARD's long-term JESS field team in Somalia. In addition, a series of "special studies"--requiring more than 40 person-months of ARD home-office scientists, subcontractors and consultants--was proposed to focus on specific topics.

The longer term socioeconomic baseline studies (SEBS) were planned around a comprehensive household/family survey of randomly selected villages and towns in the Jubba Valley. The survey would cover aspects such as a demographic profile, family resources management and allocation, health and nutrition, social services, land tenure and resources-use rights. SEBS later involved special emphasis through a women's baseline survey (WBS) in order to assess issues related to the role of women in development. A separate initiative was also accorded the JESS marketing survey (MARS) to assess marketing and price structures for agricultural commodities. These studies were to be directed by JESS anthropologists and the JESS socioeconomicist.

The environmental baseline studies proposed in the Phase II work plan later became terrestrial ecology baseline studies (TEBS) due to a shift in focus to the study of vegetation and land use changes in the riverine and floodplain areas associated with the Jubba River. JESS' tropical ecologist would spearhead the TEBS effort with support from various consultants in forestry, botany, wildlife management and remote sensing.

Special short-term investigations were planned for Phase II to fill gaps of technical information in scientifically narrow areas. The following studies were proposed in the Phase II work plan. The investigations actually carried out and the related levels of effort are presented in Appendix A for comparison.

<u>Study</u>	<u>Person-Months</u>
<u>Hydrology</u>	
sedimentation	1.50
river scour	<u>1.50</u>
<u>Water Quality/Public Health</u>	
water quality	3.00
public health	3.00
vector survey	1.00
water supply	<u>2.25</u>
<u>Vegetation Studies</u>	
botany	2.00
ethnobotany	1.00
forestry	<u>2.00</u>
<u>Wildlife</u>	
inventory	2.00
ornithology	<u>1.50</u>
<u>Aquatic Resources</u>	
fisheries	4.00
limnology	<u>1.00</u>
<u>Socioeconomic Studies</u>	
land tenure	3.00
pastoralism	3.00
irrigation	2.00
nutrition	2.00
institutional	1.00
cultural heritage	<u>3.75</u>
<u>Remote Sensing</u>	
aerial census	4.00
satellite imagery	2.00
photography	<u>1.00</u>
<u>Date Management</u>	
study design	1.00
analysis startup	<u>1.00</u>
<u>Total</u>	49.50

An important aspect discussed in the work plan was the need for flexibility:

In developed and industrialized countries, a proposed two-year work plan that encompasses complex, interrelated socioeconomic and environmental studies would be offered as a tentative description of intent. In a developing country, such a work plan is, of necessity, even more tentative and requires even greater flexibility. For this reason, the Phase II work plan is a working document that will undergo revision by ARD and the JESS team during periodic management and technical reviews and at other times, if necessary. (p. 12)

With the final design and specifications of the proposed Baardheere Dam and development projects for the Jubba Valley still undergoing study and revision, exact needs for environmental and socioeconomic assessments have become somewhat of a "moving target." Thanks to the flexibility and responsiveness of USAID project management and ARD's JESS field team, various studies were revised, revamped, rescheduled or replaced with research more relevant to the realities of an evolving development project.

A 12 August 1987 amendment to the USAID/ARD contract deleted certain aspects from consideration under JESS--primarily aspects of surface water hydrology, geology/seismology, climate, wildlife, reforestation and mineral development--and redoubling efforts in nutritional analysis, health and epidemiology. At the end of Phase II, another contract amendment was being prepared to deal with more recent evolutions in project development and information needs.

To this end, the Phase II work plan provided guidelines in scoping the array of studies actually carried out during the phase. By the same token, certain components of the plan were not implemented and these are not given further treatment in this report.

#### B. Project Liaison

In ARD's proposal and Phase II work plan, the firm described a willingness and intention to establish liaison with development projects and ministries with operations in the Jubba Valley. Throughout Phase II, JESS developed an earned reputation for a willingness to cooperate with other projects and ministries, often exchanging data at informal and formal levels. These exchanges always took place with full knowledge of MJVD (later

MNPJVD) and USAID. Toward the end of Phase II, USAID personnel would routinely suggest to incoming consultants and project design personnel to take advantage of the long-term JESS experience in Somalia.

It is not an intent of this report to minutely detail all liaison episodes during Phase II, but rather to highlight, with brevity and clarity, the more significant exchanges between JESS and other organizations. There are many other organizations and individual consultants who have had direct contact with the JESS team. The following list merely illustrates the wide range of contacts established in Phase II in keeping with ARD's proposal and Phase II work plan.

Land Tenure Center (LTC) of the University of Wisconsin. From the onset of this project, JESS encouraged a close working relationship with two LTC researchers. JESS assisted with logistics, personnel and advice and received considerable support in data collection in return. LTC researcher routinely visited JESS team members and participated in some JESS team meetings to exchange information whenever they returned to Mogadisho from their fieldwork. JESS team members made attempts to visit LTC field sites in the Jubba Valley whenever activities were in proximity. As a result of this close liaison, LTC will produce a report on land tenure issues in the Jubba Valley for JESS use.

SARSA. JESS established close working relationships with the SARSA team throughout its one-year project period in Somalia. Several joint team meetings were held and data were freely exchanged. Both teams made every effort to coordinate work and standardize data collection to avoid overlapping efforts. SARSA and JESS allowed free access to individual and team data sets and material.

Livestock Marketing and Health (LMH). While it was not necessary to hold joint team meetings, JESS and LMH freely exchanged data on livestock practices in the Jubba Valley. Members from both teams routinely attended consultant debriefings that were of common interest.

Central Rangelands Development Project (CRDP). While JESS and CRDP have different geographic venues of interest, numerous shared sectoral or technical activities were commonly exchanged between projects. Terrestrial ecologists on both teams pooled resources at times for taxonomic assistance, and social scientists compared survey techniques. To a limited degree, the projects provided assistance in logistics.

British Forestry Project. The JESS ecologist had numerous meetings with members of the British Forestry Project in regards to vegetation and land use mapping.

World Concern. JESS had two unique experiences with World Concern. During floods in May 1987, World Concern asked JESS to assist in rescue operations near Luuq. Refugee fields had flooded severely and many irrigation pumps were underwater. JESS responded with a loan of one boat and two boat pilots, which enabled World Concern to rescue a majority of refugee irrigation pumps before they rusted beyond repair.

In a second instance, World Concern volunteered to perform an anemia survey in Jilib after JESS was forced to cancel a similar study with the Refugee Health Unit (RHU) of the National Refugee Commission. Under this agreement, JESS loaned two hemoglobin spectrophotometers that had been purchased for the RHU study to World Concern in exchange for data to be collected between March and June 1988.

Halcrow Fox Associates (HFA). HFA is conducting a resettlement study for MNPJVD. JESS was HFA's first contact in Somalia for information and logistic support. During 1987 and early 1988, a very close working relationship developed between JESS and HFA. Information and assistance have been given in both directions throughout this study. Incoming HFA consultants are routinely briefed by JESS before the onset of their fieldwork. With permission of MNPJVD, HFA has relied heavily on JESS equipment for fieldwork and will continue to do so until the resettlement study is concluded.

World Bank. JESS provided strong assistance to a World Bank pre-appraisal mission for the Baardheere Dam in regards to environmental and resettlement issues. JESS organized and implemented a field trip to the reservoir area for the World Bank team. JESS has also provided liaison between MNPJVD and the World Bank in regards to archeology studies.

UN High Commissioner for Refugees (UNHCR). JESS has held several meetings with resettlement teams from UNHCR. JESS reports and field notes have been made available to these teams as well as remote-sensing products developed during JESS.

Somali Academy of Science (Somac). Through studies in archeology and land tenure, JESS has worked with Somac counterparts in an attempt to encourage wider participation of Somali scientists.

National University of Somalia. JESS has utilized expertise in the Faculty of Medicine and Faculty of Chemistry to conduct studies in epidemiology, water quality and limnology. JESS was instrumental in arranging turnover of a USBR atomic absorption spectrophotometer and other laboratory equipment before the end of the JuDAS project.

Ministry of Health (MoH). JESS worked closely with MoH in planning and implementing an epidemiology survey in the Lower Jubba Valley. MoH supervisors and technicians were used to conduct this study with JESS financing and logistics.

World Health Organization (WHO). JESS also worked closely with WHO officials in planning and implementing the epidemiology surveys. With this liaison, the survey was conducted under standards endorsed by WHO. Reports of study results were presented to WHO at an individual debriefing.

Ministry of Fish and Marine Resources (MFMR). JESS has maintained a close relationship with MFMR throughout Phase II studies. Personnel from this ministry have used JESS boats and equipment to conduct freshwater fisheries research in both Somali rivers. The equipment was also used to assist two fishery cooperatives, one at each river.

Baardheere Dam Technical Committee. The JESS team leader is a member of this committee at the invitation of the Baardheere Dam Project.

### C. Linkages to Jubba Valley Development Master Plan

According to USAID's JuDAS project paper and the scope of work of ARD's technical assistance contract, the purpose of JESS is to generate environmental and socioeconomic information necessary for the creation of a master plan for Jubba Valley development. MNPJVD has overall authority for coordination of the master plan, while GTZ is financing technical assistance through the Agrar- und Hydrotechnik (AHT) master planning team.

Both JESS and master planning efforts were to be coordinated in a timely manner by MNPJVD. As ARD's contract for JESS states:

At the end of Phase II, the Contractor shall submit a comprehensive and detailed report, including annexes of data collected and an outline of the perceived potential environmental/sociological impacts of various development scenarios which will be assessed in detail in Phase III. (p. 12)

Under Phase III, the contractor shall analyze and assess environmental and sociological impacts of proposed development projects . . . (p. 13)

Provide the GSDR with timely information to be used in formulating a socially and environmentally sound master plan for the Jubba Valley . . . (p. 13)

It is worthwhile to note that JESS and master plan schedules are not in synchronization. Because these two projects were funded, negotiated, designed and planned by different donors, their schedules were not coordinated. JESS Phase II began in April 1986 and ended in March 1988. Products from JESS Phase II were to be used by master planners for preparation of Master Plan Volume 1: Present Stage of Development. This volume, however, was released in December 1987.

AHT's Master Plan Volume 2: Regional Development Strategy is scheduled for release at the end of May 1988. Volume 2 will define a series of alternative development projects for the Jubba Valley. While AHT can take advantage of JESS Phase II baseline information, analyses of baseline studies data will not be completed until the end of JESS Phase III, with the release of the draft JESS final report in August. AHT's Master Plan Volume 3: Jubba Valley Development Investment Program is not scheduled for release until mid-December 1988, just one week after the scheduled presentation of the JESS final report (with incorporation of review comments on the draft report).

With these timing and scheduling constraints, it was required that JESS staff open informal channels of information exchange with the AHT master planning team. Throughout Phase II, USAID, MNPJVD, AHT and a wide audience of reviewers have been kept informed of JESS activities and research results through a series of timely interim reports prepared by consultants and long-term JESS staff (see Appendix B). In addition, 28 monthly reports, released during implementation of Phases I and II, have seen wide distribution in Somalia and elsewhere. SEBS data bases and other research materials, including aerial photographs, water-quality sampling data, field trip notes, vegetation maps and aerial censuses, have been turned over to the master planning team as a matter of course. Various debriefings by consultants completing short-term investigations, JESS/AHT inter-team meetings and informal one-on-one collaboration between JESS staff members and AHT consultants have been mutually beneficial to both teams' efforts in data collection.

JESS will continue to provide similar, if not more intensive collaboration during Phase III in order to expedite information exchange. Inasmuch as the conflicts in scheduling will allow, JESS will seek to enhance the master planning team's capability to design environmentally and socially sound development projects for the Jubba Valley through the release of pertinent data analyses as they evolve during JESS Phase III.

With the release of AHT's Master Plan Volume 2, JESS will be better able to respond to assessing potentials for the environmental and socioeconomic effects of proposed development projects. The level of specificity of these assessments will depend, in turn, on the level of treatment (design and

development) of projects proposed in this volume. Recommendations for the mitigation and/or avoidance of impacts, or for enhancing development aspects of proposed projects, will be handled within the context of the inherent limitations of Somalia's sociopolitical and economic reality--i.e., recommendations will be appropriate in terms of funding limitations and the plausibility of actually implementing them.

D. Phase II Transition to Phase III

Phase II activities actually commenced with fieldwork in the Jubba Valley before Phase I ended in April 1986. Field data collection was completed in February 1988. Under terms of ARD's contract with USAID, JESS must "prepare a comprehensive report with annexes on the data collected"--presumably during Phase II. The contract further adds that this report:

will be used in discussions with USAID/Somalia, MJVD and coordinators of the Master Plan for Jubba Valley Development, to determine if sufficient data have been collected in order to formulate the final assessment and plan of action.

Prior to the conclusion of Phase II field studies, a collective opinion had been formed among USAID/Somalia, MNPJVD and AHT's master planning team that, owing to extensive collaboration and dissemination of data throughout this phase (see above), further discussion to assess field data was unnecessary, and JESS should get promptly to data analysis. Thus, this Phase II report has been restructured accordingly to serve more as a description of activities, methodologies and preliminary results than as a decision mechanism to determine whether analysis should proceed or if further data collection is necessary. This opinion to emphasize analysis rather than preliminary reporting was initially suggested following a USAID/REDSO/EA evaluation of JESS socioeconomic surveys.

To this end, this Phase II report is intended to be a summary document of JESS activities, accomplishments and preliminary findings. Further, certain preliminary results, extracted from interim reports and field notes, will be highlighted. However, readers are cautioned that results from long-term baseline surveys for socioeconomics, terrestrial ecology, women's issues and marketing will not be fully available until data are analyzed in Phase III, as was intended in the three-phase project design.

Readers will be reminded throughout this report that AHT has conducted far more studies in preparation of the Jubba Valley development master plan than had been envisioned by project designers. Because of close coordination between JESS and AHT,

both teams took care in implementing field studies so as to avoid wasteful duplication. As a result, JESS and AHT studies are both complementary and supplementary instead of being competitive. Both JESS and AHT have been assisted by other project studies within the Jubba Valley commissioned by USAID, MNPJVD and other donors. This had not originally been envisioned by project designers.

While this report marks the end of Phase II and the beginning of Phase III, the change is not abrupt--rather, JESS will experience a transition from data collection into data analysis and interpretation of research results. Raw field data from SEBS, WBS, TEBS and MARS are still being entered into files, cleaned and structured for analysis. Reports on several short-term investigations are still in various stages of final preparation, slated for completion by the end of April 1988.

On the other hand, JESS began various analytical initiatives early in Phase II. Three interim reports (Nos. 5, 6 and 16) were published. In synthesizing then-current information about the potential impacts of construction of the Baardheere Dam, these interim reports highlighted issues concerning dam design and the need for well-planned, orderly development of the proposed project. Some 32 separate short-term investigations were completed during Phase II, with analyses and recommendations published in separately released reports (see Appendix B). Preliminary assessments were also made during Phase II concerning the creation of a system for long-term environmental and socioeconomic monitoring.

Two major activities will occupy JESS staff during Phase III:

- the analysis and interpretation of data generated through JESS long-term baseline studies (SEBS, WEBS, MARS, TEBS); and
- preparation of the JESS final report.

As intended in the project design, information collected during Phase II will be processed and analyzed during Phase III. As discussed later in this report (Section IV), separate, stand-alone reports will be prepared for each series of long-term baseline studies (SEBS, MARS and TEBS). These will be added to the group of short-term and intermittent investigation reports to complete JESS' contribution of environmental and socioeconomic studies to the proposed Jubba Valley development.

From direct analyses of JESS research and review of other data and literature with relevance to Jubba Valley development (i.e., AHT studies), the JESS final report will be prepared. This report will synthesize available information into a single,

succinct executive volume of less than 100 pages dealing with the environmental and socioeconomic implications of construction of the Baardheere Dam and subsequent development of the Jubba Valley. All other JESS reports of long-term baseline studies and short-term investigations will be annexed to the executive volume. Research materials including, principal data bases and code books, tabular data, field maps, site descriptions, and aerial photographs, will be prepared for transfer to MNPJVD.

### III. PHASE II ACTIVITIES AND ACCOMPLISHMENTS

Phase II of JESS was intended as a two-year period of field data collection. This phase was also intended to generate a "preliminary assessment of the environmental and sociological effects of irrigation and dam development" (USAID/ARD contract, p. 11). As stipulated in the contract and ARD's Phase II work plan, JESS created an interim reporting scheme that continually provided information on the ongoing research.

During Phase II, 25 consultants, together with JESS long-term field staff and ARD home-office technical staff, provided 525 person-days of effort in Somalia, resulting in 33 interim reports concerning various aspects of environmental and socioeconomic conditions in the project area and the effects of proposed dam construction and subsequent development of the Jubba Valley (see Appendix B). In addition, 24 monthly reports, two annual reports and numerous field-trip reports have been distributed to USAID, MNPJVD, the AHT master planning team and other organizations concerned with development issues in Somalia (World Bank, NAS and other GS DR ministries).

JESS Phase II research can be divided into two main categories: longer term socioeconomic and terrestrial ecology baseline studies carried out by JESS resident scientists; and short-term or intermittent, sector-specific investigations, carried out by visiting consultants. Longer term studies were designed to collect data continually throughout Phase II in order to characterize the existing environment and create a comprehensive baseline on which could be based informed decisions regarding the design, construction and operation of the proposed dam and subsequent development of the Jubba Valley. As data collection proceeded, the master planning team was encouraged to review and apply information that directly suited their needs.

The short-term or intermittent investigations were scheduled according to the Somali climatic calendar. Consultants, in most cases, were scheduled for fieldwork when conditions of rainy and dry seasons were most relevant to their work--e.g., water quality investigations were planned for extremes of low and high flows; epidemiological surveys were planned for maximum transmission seasons; and aerial censuses and photography runs were planned for cloudless periods. Reporting on these short-term investigations was designed to be immediate, with draft reports released for comment as soon as possible after fieldwork was completed. Later, final reports were published and widely distributed, making pertinent findings and recommendations available to MNPJVD and the master planning team.

The following subsections deal specifically with JESS Phase II research activities. For longer term baseline studies, the

results of which are due to be analyzed during Phase III, objectives of each initiative as well as field and analytical methods are described. For short-term and/or intermittent investigations, for which results have already been published (or soon will be), a summary description of each study, its rationale, objectives and pertinent findings are presented.

#### A. Socioeconomic Baseline Studies

After reviewing the quantity and quality of existing information during Phase I, it was found that there existed no uniform baseline of sufficient geographic coverage to adequately characterize communities and people inhabiting the Jubba Valley. Little was known of the populations in terms of their absolute numbers or characteristics of their social and economic systems. No comprehensive social profiles had ever been developed for the area. Consequently, the JESS study necessitated developing a broad data base, starting with the most rudimentary population characteristics. The outline for socioeconomic data collection was developed during preparation of the Phase II work plan by ARD in February and March 1986.

##### 1. Field Data Collection

###### Sondeo

As outlined in the Phase II work plan, the period of formal socioeconomic survey research was preceded by an initial period of rapid reconnaissance, or a sondeo. The rapid-reconnaissance phase of the socioeconomic studies was conducted from mid-March through August 1986.

The purpose of the sondeo was to construct a general overview of social and economic characteristics of the Jubba Valley. This overview was based largely on qualitative assessments resulting from on-the-ground observations as well as extensive interviews with the valley's public administrators, local leaders and long-term residents. An important aspect of the sondeo was to gain familiarity with the area in order to carefully plan the scale, scope, logistics and timing of studies--particularly with regard to seasonal constraints to travel. An equally important task was to inform valley residents and local authorities of the purpose of JESS.

The sondeo focused on local-level social and economic production systems and their relationship to Jubba Valley resources. Information pertinent to this topic was gathered principally through village meetings, open-ended forums conducted in 26 villages throughout the valley. Meetings lasted from one

to four hours and covered a wide range of topics, including a brief village historical sketch, number of current households, economic activities, adaptive responses to floods and drought, village governance, land tenure, interaction with other valley groups (especially between settled agriculturalists and seasonally transient pastoralists), livestock and human health issues, and village development priorities.

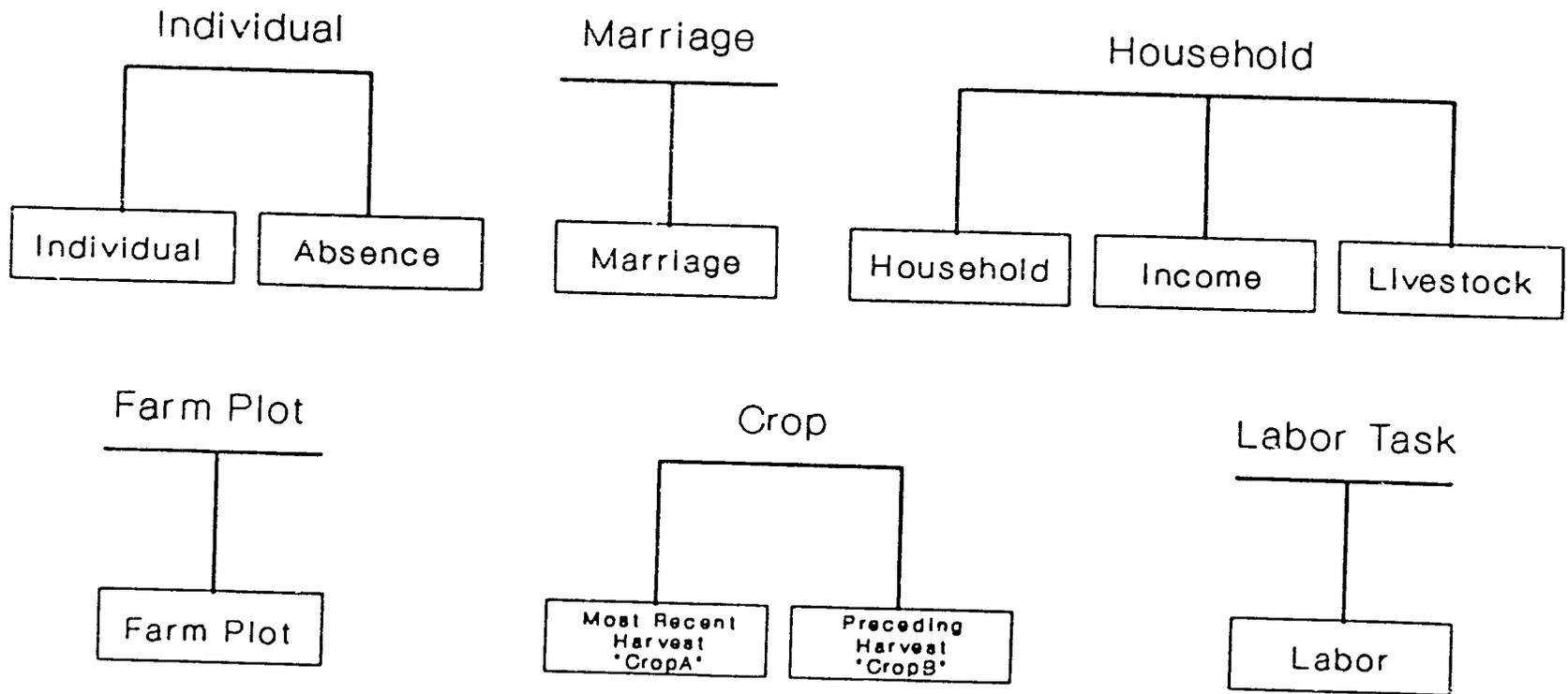
Additionally, because the Somali method of reckoning time is different from western methods, historical chronologies were established for several parts of the valley in an effort to match up memorable events with western calendar years. Chronologies listed historical events known commonly to valley residents (e.g., the year of Somali independence, a particular drought or epidemic) and were developed specifically for survey use. The list of events established benchmark reference points from which informant responses regarding temporal events, such as dates of births, deaths, marriages and times of important economic transactions, could be meaningfully recorded in calendar terms. The sondeo also involved compiling nearly complete lists of villages and beelo (subdistrict units) within each district. Lists were later used in the baseline survey for random selection of sample villages.

### Survey Instrument Design

Design of the survey instrument began during Phase I, with the principal areas of inquiry being drawn from the USAID project paper, the scope of work of ARD's contract, and from JESS scientists' familiarity with the effects of water development projects in Africa. Principal elements to be covered by the survey were originally to be specified by the AHT master planning team, but relevant AHT team members were not yet available. Several months were spent finalizing areas of inquiry and on the instrument's physical design, with a view toward more efficient data entry and subsequent analysis, both to be handled on microcomputers using commercial software.

In order to address units of analysis, the questionnaire was divided among units, including: individual, marriage, household, farm plot, crop and labor task. For example, age, sex, occupation and education of each member of a family relate only to each individual; the number of cattle or fruit trees owned by a family relates not to an individual, but to a household as a whole. Because some of these units of analysis (household, crop) generated too much data for one data file, these were further subdivided (see Figure 2). Each section is briefly described below:

Figure 2. Structure of SEBS Questionnaire



- The Individual section aims at providing information on demography, education levels, occupations, languages spoken and health problems.
- The Absence subsection aims at finding out where absent family members have gone, why they are absent, and whether they send aid to or receive aid from the family group.
- The Marriage subsection traces each marriage of the household head, when it occurred, how long it lasted, whether it has ended and, if so, whether due to divorce or death, and what kind of exchanges took place at the time of marriage.
- The Household section is quite general, trying to elicit information about property held by the family, housing, sanitary facilities and sources of water.
- The Income section gathers detailed information on family income and expenditures over the last year as recalled by the household head.
- Livestock follows in detail what happened to the families' animal holdings over the last year.
- Farm plot renders information on each separate agricultural landholding that the family possesses, how it was obtained, its current tenurial status, its size, and what kind of crops are usually grown on it.
- CropA and CropB subsections are in the same questionnaire form and administered once for crops planted during the most recent harvest period, and repeated again for the harvest prior to that. The questionnaire covers plantings even if there was no harvest due to pests, drought or flood. Sales, consumption, gifts and storage of each crop are all recorded. Purchases of the same kind of crop are also recorded to ascertain how self-sufficient any particular family or area is in that crop.
- The Labor section gives details about labor used for farm work, for which tasks, whether it was volunteered or hired, and what payment was made.

An identification code was given to each questionnaire based on region (total of three), district (10 total), beel and village (53 total) and household (1,057 total in sample). This

facilitates linkage of subsections and units during data analysis.

The SEBS questionnaire underwent a total of three pretests followed by a fourth and final revision prior to launching the survey. The first and second pretests were conducted in Jilib District in mid-September and late October 1986, followed by a final pretest in Baardheere District in early December 1986. The extensive pretest phase enabled JESS to learn how to ask the right questions in the right way and was necessary for developing a fine-tuned, efficient questionnaire that was comprehensive enough to incorporate the variability of riverine agricultural, agro-pastoral, pastoral and urban populations encompassed within the 600-kilometer stretch of the Jubba Valley. The final document is 27 pages, consisting of several hundred possible questions depending on the particulars of an individual respondent's family size or economic holdings. The original questionnaire was much larger as a result of attempting to incorporate the questions of a broad range of interested parties (e.g., Ministries of Health, Agriculture, Livestock). Ultimately, it was necessary to simplify and reduce the total number of questions in order to make the final product manageable.

During the sondeo JESS recruited and trained 12 enumerators. At MNPJVD's request, the majority of JESS field staff were recruited from the valley. Although field recruitment procedures were time-consuming, these efforts reaped benefits in terms of team members' increased knowledge of the valley and their familiarity with local dialects. Once selected, staff were extensively trained in survey research methods, coding, interview techniques and, in some cases, remedial English.

### Sampling Frame and Survey Administration

Jubba Valley, aside from the river floodplain, has few clearly distinguishable geographic or surface geomorphological characteristics, nor can it be defined as a single political unit. The river itself is encompassed within Somalia by three regions--Gedo, Middle Jubba and Lower Jubba--and transects eight districts within these three regions. For lack of readily identifiable boundaries, the survey area, as defined, included a 30-kilometer stretch either side of the length of the Jubba, corresponding with the same area covered in the aerial census. In sparsely settled areas of Gedo Region, it was necessary to occasionally increase the sampling area to 40 or 50 kilometers beyond the river to include settled agricultural villages. In the case of pastoral nomads who are only seasonally within range of the Jubba River, the survey team traveled up to 80 kilometers from the Jubba to contact pastoral populations at Afmadow and Faafxadhuun.

In defining the sample population, the SEBS team began with an assumption that social and economic patterns within the valley are shaped, constrained or otherwise influenced by the Jubba River and that that degree of influence is a function of the distance of those populations from the river. To ensure representation of the valley's major economic modes and population clusters, the total sample was stratified into urban (district centers), agricultural and pastoral nomadic subsamples. Within each subsample, household was selected as the basic unit of analysis because household is the social unit of economic production common to each stratum of the sample, and because nearly all persons living in the valley are members of households as defined in the research design.

Owing to a lack of reliable census figures from the Jubba Valley and a paucity of data indicating size and variability both within and among economic production groups, sample size of each stratum within the survey was arbitrarily assigned. For example, it was known that during most of the year and under normal climatic conditions, settled agricultural populations comprise the largest single group within the valley. The urban population was sampled in half the number of the rural population. The pastoral population is generally regarded to be smaller in size than the permanently settled population and is absent from the valley in large numbers for most of the year except in the dry seasons and extended drought periods. There was some minimal risk in possible under- or overweighting of each stratum of the total sample. Statistical profiles will be developed on each stratum individually, and the results can then be confidently used for comparison with the other strata. The important thing was for each stratum to have a sample size large enough to merit statistical significance.

With consideration of time versus statistical reliability, the team planned a total sample size of 1,000 households, broken down in the following manner:

Settled agriculturalists	500 households
Urban dwellers	250 households
Pastoralists	<u>250</u> households
Total	1,000 households

A final total of 1,057 households were in fact interviewed from 53 villages in the course of the SEBS between January 1987 and completion of the survey in mid-February 1988. Given a total valley population of roughly 500,000 (AHT, Master Plan Volume 1), the sample population equals 1.5 percent of the population.

Sample agricultural villages were selected from village lists collected during the sondeo phase of research. Villages were selected in rank order of their numbers until four villages were chosen which fit the predetermined geographical criteria-- two villages on opposite banks of the river located on or near the river, and two villages on opposite banks located five kilometers or more from the river (i.e., outside of the floodplain).

Villages were contacted one or two days in advance of the actual survey day. Survey purpose and procedures were discussed with village elders who in turn were requested to disseminate the information to villagers and to assemble all household heads in the village on the day of the survey. On the appointed survey day, the SEBS team arrived at each village at a previously scheduled time. The guddoomiye (village leader) then was requested to recite a list of all village household heads resident within the village. The list, recorded by the SEBS team, was used in conjunction with a random table to select the day's interviewees. If a selected household head was unavailable for interviewing, a substitute was chosen in rank order from the random numbers list. Following respondent selection, each interviewee was assigned to a JESS enumerator who accompanied the respondent to his or her home, where the demographic and economic responses were more verifiable and where a greater degree of privacy and respondent confidentiality could be ensured. While selected respondents were being interviewed, SEBS team leaders, with the help of field assistants/translators, conducted village meetings with all of the additional villagers assembled. Separate meetings were held for men and women. These were open-ended sessions in which a wide range of topics were covered (similar to the sondeo village meetings) of general concern to the village as a whole, but usually centering on economic and health-related issues.

The urban sample surveys were relatively simple to execute based on the highly organized structure of each of the district capitals into units known as xaafada and subunits called tabeelo. In general, each xaafad was composed of an equal number of tabeelo, and each tabeel was composed of an equal number of households. With the help of town council leaders who assisted in identifying unit boundaries, an equal number of households were selected in each tabeelo for participation in the survey.

Sampling nomadic populations has long posed a problem to social science researchers. Their high degree of mobility and lack of consistent aggregation render these populations difficult to locate and sample randomly. Accepting these constraints as given, the SEBS team opted for an opportunistic sample of pastorally oriented households. In each district, approximately 30 household heads were selected from a "representative" sample

located at one or two water points (river bank, dhesheeg, well) located, if possible, on each side of the river.

### Women's Baseline Survey

The WBS is a component of SEBS and is meant to complement its data. A special effort was made to interview women because in Muslim societies women frequently do not participate in public discussions with men. Therefore, women's views and needs can easily be overlooked. Women make major contributions to agricultural and pastoral production systems and family decision-making in health and resource allocation. Their contributions should be clearly understood to plan for their incorporation in development processes. In addition, women are usually the best sources of information about their own reproductive histories and their families' health and nutrition.

The WBS questionnaire was developed following final revision of the SEBS questionnaire. The WBS questionnaire was designed to mirror SEBS by Individual, Absence and Marriage sections from a woman's perspective (e.g., her successive marriages and offspring) rather than focusing on the male household head and his marital and reproductive history as the SEBS does. The WBS questionnaire includes a section on Family that elicits information on polygyny, inheritance and family assistance. The Divorce and Widow sections elicit information on a woman's means of support during periods without a spouse. The section on Economic Activities focuses on a woman's control of economic resources and participation in cash-earning activities. The Health/Nutrition section emphasizes children's health, women's health and reproduction, and family consumption patterns. The WBS questionnaire was revised three times following field trips to Jamaame, Kismaayo, and Baardheere districts.

The women's survey team accompanied the SEBS team to the field and utilized the same stratified random sampling frame. Villagers, notified a day or two in advance, were asked to gather on the day of the survey for a men's or a women's village meeting as well as for individual interviews. The women's village meeting was held to gain qualitative information about the history of the village, women's role in the village production system, sources of water and firewood, medical problems and treatments, knowledge of and attitudes toward health practices, usual diet, cash-earning activities for women, and status of female-headed households. Female household heads were included in the random selection of respondents to be interviewed for SEBS. Respondents for the WBS were selected from those attending the village meeting.

A total of 276 women's interviews were completed in nine districts of the Jubba Valley. These included 99 urban, 130

agricultural, and 47 pastoral interviews. Thirty-eight women's village meetings were held.

## 2. Data Entry and Processing

After the last pretest, the SEBS and WBS questionnaire formats were altered to accommodate coding columns on the form, and a code book was written.

At each survey site, all the questionnaires were spot-checked by the field assistants and team leaders to check for obvious errors that could be corrected before leaving the village. Each night at the base camp, the day's questionnaires were carefully checked for errors and inconsistencies. Enumeration errors were discussed with the relevant team members. Once checked in the field, completed questionnaires were brought to the JESS data center in Mogadisho after each field visit.

When the enumeration team returned from the field, questionnaires were coded and then submitted to another check for both enumeration and coding errors. Finally, the questionnaires were handed over to data entry personnel so that the data could be entered into computers. A person thoroughly familiar with the code book and the type of logical errors committed by enumerators checked every single question and code on every single questionnaire. This data center coordinator was hired under JESS to coordinate the "cleaning" of the questionnaires before coded data were actually entered, as well as to supervise data center staff.

Data were entered on IBM AT and PC's Limited AT clones through a customized program in dBASE III+ developed by JESS management information specialist, Mr. Leonard Malczynski (see JESS Report No. 22). Once entered, the data are being manipulated and analyzed using STATPAC software.

As mentioned earlier, each questionnaire was given a unique identification number, which is used regardless of how many units or sections of data (files) are created. This way, the 10 subsections of each household's questionnaire all carry the same composite identification number. In dBASE III+, two files can be linked with this number or part of the number since the component parts of the number exist as separate fields as well. This greatly simplifies the selection of subsets of material from the larger data base. For instance, all data from Village 1 in Jilib District can be extracted from all files in Jilib District. Likewise, all data in one file from Jilib District can be extracted from that file for Middle Jubba Region by selecting the code number for Jilib District. The same file for two different regions can also be linked, permitting broader geographical analyses when necessary.

As of 25 March 1988, all SEBS questionnaires and 165 WBS questionnaires had been entered and data restructuring (to facilitate manipulation) and analyses were underway.

## B. Market Survey

Review of literature and development program reports during Phase I yielded little information about markets for agricultural produce. Development of the Jubba Valley will dramatically change levels of agricultural production and product mixes, which in turn will affect existing marketing and transport networks, prices, and supply of and demand for products.

JESS determined that a market survey was needed to characterize existing markets and the flow and pricing of goods throughout the year. With this information, causes of price fluctuation can be understood and initiatives taken where necessary to improve distribution, and avoid shortages and price gouging. Having good price information is also valuable in planning imports, levying taxes and setting price policies for those sectors in which the government intervenes.

### 1. Field Data Collection

In order to obtain price information for the Jubba Valley, market surveyors were established in three major towns on the Jubba River--Jilib, Kismaayo and Baardheere. Surveyors were selected from these same communities and trained in data collection techniques. Buurdhuubo was added to the survey because it is a major market center for upper-Jubba refugee camps. The survey was initiated in January 1987 for the three major towns and begun in Buurdhuubo in April 1987.

### Questionnaire Design

The MARS questionnaire is composed of eight sections: three checklists for item availability on a given day, and five more detailed price lists that cover wholesale and retail prices, the number of sellers, measures used, product origin and, for some items, transport mode and costs, taxes and brokerage fees. The three checklists are for vegetables and grains (the regular market, which also includes meat and milk), fish, and live animals. These checklists are filled out every other week in order to track commodities as they appear and disappear from the various markets. The regular price sections of the questionnaire also cover vegetables and grains, fish, and live animals (for which there are separate pages for interviewing both the seller and buyer), as well as an additional section for wood, thatch and fodder.

In addition to questionnaires, the market surveyors were asked to keep notebooks to record sudden price changes or other unusual events affecting their markets. These notes were collected for translation every few months and will be used to augment the marketing analyses drawn from the questionnaires. Examples of observations recorded in this manner were: an overnight jump in maize prices in Jilib when a busload of traders came from Mogadisho on a major buying trip; the disappearance of certain woods and fodder grasses from the Kismaayo market with the onset of the rains; and the disappearance of construction wood from the Baardheere market due to new government regulations.

### Sample Frame

There are obvious differences in the markets covered by the JESS survey. Kismaayo is a very large town (the third largest in Somalia) and has many daily markets (compared to a single one in the other survey towns). At the latter sites there is one principal market with separate sections for the sale of meat, milk and wood, and in some cases fish. In all towns, the animal market is in a different place from the main market, usually removed from the center of town altogether. Because of Kismaayo's size compared to other market sites, surveyors had to use a different approach in collecting information there. In Jilib, Baardheere and Buurdhuubo, checklists were filled in once every two weeks and price and availability information at least twice a month for each item sold in a particular town. For Kismaayo, the surveyors did double duty--one major and one minor market were covered each week (checklist one week and then price list). Because of the uneven number of markets, this led to a fairly complicated schedule of enumeration. In other market towns, three checklists were filled out one week and the price lists and more detailed interviews the next.

The JESS socioeconomist, who had primary responsibility within JESS for this study, spent a good deal of time initially both training and supervising the market surveyors, making at least seven trips to the Jubba Valley to organize or supervise this study. After an initial period of fairly close supervision, however, the study was self-driven, either with other JESS team members picking up forms and paying surveyors when they traveled to the valley, or with surveyors making bimonthly trips to Mogadisho to drop off the forms.

## 2. Data Entry and Analysis

Market data were entered using Lotus 1-2-3 software; all questionnaires completed to date have been entered. The survey was to extend until June 1988, but GSDR price controls instituted

in February rendered highly unlikely the possibility of gathering anything but irregular price information, which would skew analyses. Hence, the survey was ended with just over one year of data.

The following aspects are planned for analyses:

- Seasonal disappearance of any of the 48 items from the "Vegcheck" list in Kismaayo, Jilib, Baardheere and Buurdhuubo matched with price lines for those items from their first appearance in the market to their disappearance;
- average monthly price per kilogram of all 48 items on a market-by-market basis--each of the Kismaayo markets can be averaged separately, then they can be averaged together for an average monthly price for all of Kismaayo;
- for each of the four market sites, prices for each commodity averaged together to show seasonal price fluctuations in the Jubba Valley;
- where there is sufficient information, the difference between average monthly wholesale and retail prices of commodities for each market;
- availability of the different types of fish in different markets by month or season, if appropriate;
- price per kilogram of fish in different markets per month;
- occurrence of different animal species and types each month in the different markets;
- percentage of live animal sales by traders versus producers in the different markets by animal species;
- average monthly price by animal type and condition in each market;
- difference between buying and selling price of each animal by type/condition for each market;
- rank order of reason for purchase by animal type (sex and condition) by season in different markets;
- rank order of reason for sale by animal type by season in different markets;

- district of animal origin by animal species for each market town;
- average monthly price per "pile" for each type of wood, thatch and fodder by market; and
- average number of piles for sale of each wood and fodder type by season and market.

### C. Terrestrial Ecology Baseline Studies

Although a review of existing information during Phase I produced a number of vegetation and land use maps, their application for characterizing the dynamics in composition and condition of vegetation--especially in the context of the soil/water interface and the influence of the Jubba River within this interface--is very limited. Most of the vegetation in the Jubba Valley is not strictly "natural" because it has been influenced significantly by human activities such as pastoralism, farming and wood collection. The effects of such activities are often visible or can be assessed by interviewing local people. In all but the most degraded sites, plant species composition, density, height and standing crop of plants are good indicators of a site's potential for development. In addition, the current status of vegetation is often a good indicator of present or recent land use practices.

#### 1. Field Data Collection

During Phase I, it was decided that a series of vegetation studies would be carried out to provide baseline information on vegetation types in the Jubba Valley, with special emphasis on determining how floodplain vegetation differs from surrounding rainfed (i.e., non-river-dependent) areas. At the same time, human use of range and forestry resources would be characterized. From these studies, future changes in vegetation due to construction and operation of a dam at Baardheere and subsequent valley development would be predicted. The same baseline would also be used for future vegetation monitoring. The primary objective of TEBS is to describe existing vegetation and how it relates to land use.

#### Study Area and Sampling Strategy

The study area can be delineated in many ways. The first level is by the three administrative regions of Gedo, Middle Jubba and Lower Jubba (120,000 square kilometers). A smaller unit is a district, eight of which encompass the river. Such massive areas cannot be sampled intensively or comprehensively

with the resources of JESS. Two recent surveys of natural resources cover most of these areas extensively (Land Use in Tsetse Affected Areas in Southern Somalia, Land Resources Development Centre, Tolworth, U.K., 1985; Southern Rangelands Survey, RMR, London, 1985). Their work will not be repeated by JESS.

The main purpose of TEBS is to look at those areas where changes are likely to occur as a result of construction of the Baardheere Dam and of other development activities. Therefore, the following broad areas were chosen for vegetation assessment and aerial censuses:

- The Jubba floodplain, including the river, from the disputed border with Ethiopia, to the estuary near Goob Weyn (2,000 square kilometers).
- The area to be inundated by the reservoir behind the proposed Baardheere Dam (500 square kilometers). This area includes all the floodplain between Luug and the dam site.
- A "river-dependent zone" (33,000 square kilometers) that is outside the floodplain and inundation area, but may be dependent on the river, future reservoir or floodplain for resources on a regular basis (particularly during the dry season). Probable human, livestock and wildlife needs were used to define this area as stretching for 30 kilometers east and west of the floodplain edge.

Changes in floodplain hydrology will occur downstream of the dam after it is closed. A major objective of the sampling strategy was to determine how the floodplain vegetation differs from the adjacent limestone plateaux and marine plains. To achieve this, it was decided that several visits were necessary to account for seasonal or longer term effects of the river and rainfall regimes.

In the proposed inundation area, seasonal changes were not monitored. Since the vegetation will be submerged, information about current seasonal effects is not useful in predicting future changes. The sampling was to assess the present status of vegetation and what will be lost when the area is flooded. In addition, vegetation in the likely drawdown area and close to, but above, the upper water limit was examined. Any future developments after the reservoir fills are likely to occur in these areas.

The river-dependent zone was not sampled uniformly or intensively during TEBS ground studies. Adequate information, including detailed descriptions of 150 ground monitoring sites,

are included in the Southern Rangelands Survey (RMR 1985). This information was supplemented by large-scale aerial photography, described below. Ground sampling concentrated on the areas close to the floodplain for three reasons. First, the effects on vegetation of floodplain hydrology and soils were best studied by comparing floodplain sites with nearby non-floodplain sites. Second, activities relating to the river and floodplain are likely to be most intense close to the floodplain. Third, future developments are likely to have a greater impact close to the river.

A multilevel approach to vegetation assessment was adopted:

- available maps using various land/vegetation classifications--these were used as bases for stratifying ground sample sites for the following two methods (which are described in the subsequent sections);
- large-scale (1:1,000) aerial photography, taken specifically for assessment of vegetation cover and size distribution of larger woody plants; and
- ground sites, in which the vegetation composition was examined in great detail, often with an assessment of seasonal changes.

### Ground Site Selection

Several criteria were used in selecting sites for intensive study on the ground. From the outset, it was decided that these sites should be suitable for long-term monitoring beyond JESS. For this purpose, the sites needed to be ones that were accessible and could be mapped accurately and located again. In addition, it was desirable that the sites be representative of the range of vegetation types in the study area.

In the floodplain, the physiographic and land use maps of AHT (Dhesheeg and Small- and Medium-Scale Irrigated Agriculture in the Juba Valley, Mogadisho, 1984) at 1:50,000 were used downstream of the dam site for stratification and mapping of the vegetation sites. For the inundation area, maps at 1:50,000 (JESS Report No. 13) were used for the same purposes. Both these map sets use the same structural vegetation classification based upon Pratt and Gwynne (Rangeland Management and Ecology in East Africa, Hodder & Stoughton, London, 1977). This basic system will be used in JESS Phase III analyses, but further elaborated to provide greater resolution.

The AHT classification allows for 64 combinations of vegetation and landform types, of which 36 occur in the Jubba

floodplain. To cover these in a statistically acceptable manner would clearly require many hundreds of sites. Such an approach is well beyond the resources of JESS. The method adopted was to choose different sites representing the range of important vegetation types and landforms. For the dhesheeg landform, for example, sites were chosen with forestland, woodland, bushland and grassland. Emphasis was given to the most widespread categories, except where sites of special ecological interest, in particular various forest types, occur.

Vegetation sites outside the floodplain were chosen using similar criteria, but without the benefit of a mapped stratification. In addition, the conditions outlined in the previous section restricted the distribution of these sites to the vicinity of the floodplain. These sites can be stratified using the land system units of RMR (1985).

In all, 90 vegetation sites were established, 36 in and around the inundation area and 54 downstream of the dam site. Of the latter, 36 were monitored seasonally over almost 18 months and the remainder over various shorter periods depending on the time of their establishment (see Table 1). The sites were established in the period July 1986 to February 1988. The JESS ecologist and Christopher Hemming, a botany consultant who was present for the July-August 1986 and July 1987 surveys (see JESS Report Nos. 9 and 23), collaborated to devise the survey methods.

#### Site Sampling and Vegetation Identification

In most cases, a square plot 20 meters by 20 meters or 10 meters by 10 meters was laid out, depending upon the density and uniformity of the vegetation. Various standard dimensions of all trees and shrubs on the plot were noted by species on the first visit to each site. Herbaceous vegetation, where present, was assessed quantitatively in two ways. First, proportional cover of grasses, forbs and dwarf shrubs was recorded using a point-frame technique. Then replicate samples of herbaceous vegetation were harvested, dried and weighed to determine standing crop. The herbaceous estimations were carried out on each visit to the site to study seasonal changes. On these seasonal visits, a phenological assessment was made of the dominant species of herbaceous and woody plants. The status of leafing, fruiting and flowering was noted along with the degree of grazing and browsing. Plant species that could not be identified in the field and were in suitable condition were collected. Four samples of each of these species were prepared and deposited in the Somali National Herbarium at the National Range Agency, the herbarium at the National University of Somalia, the Royal Botanic Garden at Kew (United Kingdom) and the East African Herbarium at the National Museums of Kenya. Dicotyledenous plants were identified by Jan Gillett at Kew and grasses and

Table 1

Dates of Establishment and Number of  
Vegetation Plots in Different Areas

Downstream of Baardheere Dam Site:

<u>Month</u>	<u>Floodplain</u>	<u>Non-Floodplain</u>	<u>Total</u>
July/August 1986	25	11	36
January 1987	9	3	12
August 1987	--	2	2
January 1988	1	3	4
Total	35	19	54

Upstream of Baardheere Dam Site:

<u>Month</u>	<u>Floodplain</u>	<u>Non-Floodplain, To Be Inundated*</u>	<u>Non-Floodplain, Above Reservoir*</u>	<u>Total</u>
July 1987	10	11	11	32
December 1987	2	2	--	4
Total	12	13	11	36

\*Exact position relative to reservoir water level is not certain;  
many of the plots to be inundated will probably be in the  
drawdown zone.

sedges by Christine Kabuye in Nairobi. The JESS working collection is housed at the National University.

At each site, a general description was prepared for plants on and around the site, surface soil type, human activities and other notable features. Wherever possible, local people were interviewed about the site in particular and the area in general. The normal scope of these interviews covered flooding patterns, climatic patterns, land use, tsetse distribution and any peculiarities of the site. The interviewees were also asked about local names for plant species and the uses made of various wild plants.

For future monitoring purposes, sites were permanently marked. A series of four standardized photographs was taken of each site. Comprehensive notes were made of how to reach each site. The full site details, including directions to sites, will be published following analyses of the vegetation data in JESS Phase III.

#### Aerial Photography and Vegetation Monitoring

To supplement the ground sites and increase sample size, 500 vertical aerial photographs were taken at a scale of approximately 1:1,000. Each photograph covers an area of approximately five hectares. These photographs are being analyzed for cover of woody vegetation and other features during the end of Phase II and beginning of Phase III. Size distribution of crown size of a sample of bushes and trees greater than two meters in diameter (two millimeters on the photograph) will also be analyzed. The objectives of this study are:

- to provide a large and well-dispersed sample of structural attributes of woody vegetation over the study area,
- to provide a tentative estimate of woody biomass in the study area, and
- to provide a baseline for extensive vegetation monitoring.

Photographs are positioned in a stratified random pattern. Within the floodplain, the stratification of 300 photographs is the same as for the ground sites, being based on AHT land use and physiographic maps. In the river-dependent zone, the stratification of the remaining 200 photographs gives a spread of random sites relative to distance from the river (east-west) and in a north-south direction along the river. The strict random criterion is relaxed to the extent of making the photographs

precisely mappable relative to landmarks. It is assumed that this process does not produce bias relative to vegetation types. The requirement that the sites be locatable was introduced for two reasons. First, the intent was to visit some of the sites on the ground to check the accuracy of photographic measurements. Unfortunately, the photographs were delivered too late for this procedure due to technical problems with the camera. Second, to use the photographs for long-term monitoring, it will be necessary to rephotograph the same areas and/or visit them on the ground in future years. The photographs of the river-dependent zone can also be stratified using the land system units of the Southern Rangelands Survey (RMR 1985).

Determination of the size distribution of bushes and trees on the photographs will be used to obtain an estimate of biomass in different vegetation types. Biomass is useful in determining the carrying capacity of an area for human needs (especially fuelwood) and for browsing livestock. These Phase III analyses will have to depend on data from other parts of eastern Africa that relate biomass of trees and bushes to crown dimensions and cover of vegetation. Such data are not available from the Jubba Valley, and their collection is outside the scope of JESS.

The method of analysis of photographs is such that it could be repeated very simply in the future if exactly the same areas were rephotographed. Thus a long-term monitoring device is provided that would require minimal fieldwork and limited skills beyond those of the pilot/photographer.

## 2. Data Entry and Analysis

Analysis of data from ground plots and vegetation photography will be largely descriptive. Requirements include the ability to classify sites spatially, in terms of vegetation structure and in terms of species composition for the ground sites. Seasonal data will be analyzed for trends.

Objectives of the analyses are to provide a comprehensive account of vegetation types and to supply pertinent information for assessment of range and forestry activities. To meet these requirements, the Reflex data base software program was selected for its visual range and ability to perform complex sorts, cross-tabulations, graphs and descriptive statistics. Further statistical analyses will be performed using STATPAC, if required.

#### D. Short-Term Investigations

During Phase II, 33 separate short-term investigations were carried out by consultants, subcontractors and ARD home-office personnel. Each investigation yielded a topic-specific technical report documenting research methods, findings and recommendations. Several of these investigations (fisheries, ornithology, botany, aerial census, public health and water quality, epidemiology, cultural heritage) were intermittent, requiring more than a single research trip to Somalia by scientists. In these cases, interim reports were prepared and published based on research results from each trip, then later combined into a comprehensive report upon completion of research.

The following subsections describe each of these short-term research initiatives by subject area. Reference is made to the conceptualization of each study in the JESS Phase II work plan. Reports from these short-term investigations were released throughout Phase II. A listing is presented in Appendix B.

##### 1. Aerial Census and Photography

The Phase II work plan did not elaborate in detail on remote-sensing activities, other than descriptions of aerial censusing to be conducted for livestock and wildlife concentrations. This lack of elaboration was not an oversight, but merely an indication that there had not been sufficient time during Phase I to evaluate all of the remote-sensing products available to JESS. During Phase II data collection, certain remote-sensing needs were determined and met.

Resource Management and Research Ltd. (RMR) was ARD's principal subcontractor for JESS remote-sensing products. During Phase II, with design input from JESS' ecologist, RMR elaborated eight major remote-sensing products for JESS--six aerial censuses and two groups of aerial photographs. Remote-sensing methods and products are fully described in JESS Report Nos. 13, 14 and 36.

Two censuses supplied total counts and mapping of features in and adjacent to the river, including wildlife (hippopotamus, crocodile), irrigation pumps, fishing activities, boats, watering points and land use features. A third census involved enumeration and mapping of all human settlements (excluding refugees) in the inundation area to supplement SEBS data, but was planned as part of the overall census package. The three remaining strip-sample censuses were much wider in scope, designed to supply seasonal information, including:

- population and biomass estimates, and distribution of livestock and larger wildlife by species;

- activities of livestock (e.g., feeding, watering, migration); and
- land use features, including estimates of house types, agricultural activities, wood extraction and water sources.

The sampling strategy employed the same areas as given in Section III.C (river, floodplain, river-dependent zone) except that in early Jiilaal, only the river and floodplain were sampled. The timing of censuses in early and late Jiilaal 1987 and Xagaa 1987 was to contrast dry- and wet-season conditions, respectively. It was hypothesized that the long dry season (Jiilaal) would be the critical time for maximum use of river floodplain and river-dependent zones. Therefore, two censuses were conducted to follow the changing patterns in these areas as desiccation progressed.

Physiographic units derived from AHT photomaps were used to stratify the floodplain south of the dam site. North of this area, the floodplain is narrow and has undifferentiated sediments; thus it was considered as a single unit. Sampling intensity in the floodplain was 10 percent. For the river-dependent zone, a six-kilometer grid pattern was used to give a three percent sample. This zone is stratified latitudinally by distance from the floodplain.

Analysis of the sample census data employs purpose-designed software retained by RMR. Raw data from the counts along individual flight lines are part of the data-base package being prepared by JESS. This very detailed information is useful for pinpointing particular features and livestock or wildlife concentrations.

In February 1987, RMR took stereo aerial photographs at approximately 1:10,000 scale of a four-kilometer strip centered on the Jubba River. JESS took delivery of two sets of the stereo pairs in March and April 1987. These 1,800 photographs were interpreted by RMR consultant Eric Trump in April and May 1987, using a classification system modified from AHT's photomaps of the Jubba Valley. The JESS ecologist assisted with the classification and interpretation. The interpretation results and land use map are presented in JESS Report No. 13. Mr. Trump also interpreted aerial photographs shot in 1960, creating a land use/vegetation map. This map will be compared to that of 1987, and the dynamics of riverine land use will be interpreted and documented in the TEBS report prepared during Phase III.

The 1:10,000 photographs also proved invaluable to the resettlement study conducted by HFA consultants for land use determinations. Towards the end of Phase II, a complete set of

photos was loaned, with MNPJVD permission, to AHT for use in master plan development.

RMR took 500 individual photographs of designated areas at a scale of 1:1,000 for the vegetation mapping activities of the TEBS. From 1:10,000-scale photography, RMR enlarged 1:5,000-scale photography of the towns of Luuq, Baardheere, Saakow, Bu'aale, Jilib, Kismaayo and Afmadow in the Jubba Valley.

## 2. Pre-Dam Concerns

In the Phase II work plan, ARD planned to produce an interim report on pre-construction concerns related to a proposed dam near Baardheere. This report was to address health, environmental and planning issues specifically related to a Baardheere context rather than discussing African experiences with dam construction in general.

During Phase II, JESS produced two reports on pre-construction and operation concerns regarding a dam near Baardheere. JESS Report No. 6, JESS Interim Report on Health Impacts of Design Alternatives for Proposed Baardheere Dam (Jobin, November 1986) was widely discussed by MNPJVD, USAID and AHT following its release. Results from this report were incorporated into Volume 1 of the master plan prepared by AHT.

JESS employed a different reporting strategy with JESS Report No. 16, JESS Working Paper - Pre-Construction Concerns with Baardheere Dam (Tillman, November 1987). This paper was circulated in draft form for intense discussions with MNPJVD, USAID, AHT and the World Bank before it was finalized for publication. It has been used as a briefing document at meetings conducted by USAID, the World Bank and MNPJVD. Various master planning consultants have also used this report to begin their work in Somalia.

## 3. Public Health

With regard to public health, the Phase II work plan defined a limited effort with the Ministry of Health. During Phase II, it was decided that JESS should expand work in this vital area, utilizing the same consultant who was working on water quality. Liaison and coordination with MoH had not been as fruitful as anticipated.

A valley-wide vector survey defined in the Phase II work plan was eliminated in favor of a more expansive and ambitious epidemiology study at the behest of USAID. Results from this study will be discussed in a separate section on epidemiology.

Dr. William Jobin of Blue Nile Associates was ARD's principal consultant on public health issues associated with JESS work. During Phase II, Dr. Jobin visited Somalia five times (March, June and December 1986; April and September 1987). During each visit, he split assignment time between water quality studies and public health issues. In November 1986, ARD released Dr. Jobin's report on health implications of various dam design options, which covered sizes of bottom outlets, turbine options and future reservoir operations (JESS Report No. 5). Also in November 1986, ARD produced a second report by Dr. Jobin on community water supply and sanitation (JESS Report No. 6). Regretfully, JESS never received comments on these reports from MNPJVD nor the master planning team. Results from these reports were not used in Volume 1 of the Master Plan.

ARD produced a third report by Dr. Jobin on water quality and public health engineering in November 1986 (JESS Report No. 7). For unknown reasons, AHT master planning consultants were not aware of these reports even though copies of all JESS reports were delivered to AHT and USBR as well as MNPJVD and USAID.

In December 1986, Dr. Jobin focused on community water supplies and disease vectors associated with water-related development projects, including hydropower and irrigation. During his fieldwork, he conducted assessment surveys for vector habitats and presence of disease vectors. Dr. Jobin also inspected and evaluated community water supply systems throughout the Jubba Valley. On the request of USAID project manager Sally Patton, Dr. Jobin prepared a proposal for an epidemiological and nutritional survey of the Jubba Valley. The proposal was subsequently adopted in modified form for a contract amendment between ARD and USAID. Results of this consultancy were made public in JESS Report No. 11, released by ARD in January 1987.

In April 1987, Dr. Jobin conducted vector surveys during fieldwork for water quality studies. In addition, he made initial contacts with potential cooperators in the epidemiological surveys with WHO, MoH and the RHU of the National Refugee Commission (NRC). This work formed the basis for an epidemiological component of a contract amendment between ARD and USAID.

Dr. Jobin returned to Somalia in September 1987 for two weeks to finalize plans for the epidemiological and nutritional surveys that had been incorporated into ARD's contract. These surveys will be discussed in the following subsection on epidemiology.

Dr. Jobin did not work with field counterparts in public health, so estimates of level of effort of drivers, cooks and assistants from the Faculty of Chemistry associated with Dr. Jobin's fieldwork were placed in estimated person-days for water

quality studies, instead of public health. Only 63 person-days have been approximated for field studies in public health issues during Phase II. This is figured on approximately half of Dr. Jobin's fieldwork in the Jubba Valley and does not count days spent in Mogadisho discussing field operations with MoH or WHO officials.

#### 4. Epidemiology

In preparing the Phase II work plan, ARD did not plan to conduct an epidemiological survey of the Jubba Valley, as this was not included in the project's scope of work. Instead, ARD planned to conduct vector surveys throughout the valley, primarily for vectors for bilharzia and malaria with optional investigations for onchocerciasis (river blindness). An epidemiology survey would require full cooperation from physicians from MoH or an international health institution, such as WHO, since it would require blood testing and administration of medicines.

At the request of USAID, Dr. Jobin prepared a proposal for a valley-wide epidemiology survey in December 1986 during one of his public health and water quality consultancies. This proposal was used to prepare a contract amendment under which an epidemiology survey would be included in JESS field activities. Active cooperation of MoH, WHO, UNICEF and NRC's RHU was sought and initially agreed upon. ARD sent Dr. Ralph Klumpp to Somalia to coordinate and conduct the survey during December 1987 and January 1988.

As envisioned, this survey would include separate, but coordinated, studies on bilharzia, malaria, onchocerciasis, anemia, nutrition and diarrheal diseases. At the height of the planning stage, 17 project vehicles and over 50 personnel from MoH, JESS and RHU would have been required. In final planning stages, supervisors and personnel for anemia, nutrition and diarrhea surveys were not forthcoming and these segments had to be canceled so as not to jeopardize the bilharzia and malaria surveys that were ready to begin. Further, because of difficult road conditions in the Middle Jubba Valley, WHO, MoH and JESS agreed to limit the bilharzia and malaria surveys to realistic levels, focusing on the most probable area of high transmission. The Jamaame area was selected for survey because of relatively good road networks, potentially high transmission and high population densities. Onchocerciasis surveys had been previously rejected by USAID as not worth the cost of bringing a blackfly expert to Somalia.

While both malaria and bilharzia teams operated from the same base camp under the overall direction of Dr. Klumpp, it is best to discuss their activities and results separately.

## Bilharzia

A total of 2,001 children between the ages of 5 and 14 in Jamaame town and 14 adjacent villages were examined for urinary bilharzia (*Schistosoma haematobium*). This included registration, urine collection, processing, filtration and quantitative egg counts. This was the largest short-term bilharzia survey ever undertaken in Somalia. At least 2,000 children who were found to be infected were treated with the most effective bilharzia drug, praziquantel. An additional 500 to 600 villagers who came to the camp uninvited from as far as Kismaayo were also treated at an impromptu camp clinic.

Dr. Klumpp also conducted snail sampling surveys in 24 villages, searching for the vector snail, *Bulinus abyssinicus*. Although, December and January are part of a low transmission season, snails infected with cercariae were found in two locations. In his report, Dr. Klumpp recommended that he return in June or July during peak transmission to conduct a valley-wide vector survey, as was envisioned in the original work plan. ARD has made plans to foster this return survey.

Results from this survey are very disconcerting, even alarming, as they demonstrate the worst bilharzia situation that Dr. Klumpp has experienced in 20 years of work in Africa. Only Jamaame town had infection rates of less than 50 percent, and one village had an infection rate of 98.1 percent. The overall infection rate was 75 percent and, if Jamaame town is excluded, the rate soars to 82 percent. In addition, infections were heavy as individual egg counts were extremely high. According to WHO standards, six villages were in a category of heavily infected and most of the other villages were very close to the limit of 50 eggs per 10-milliliter urine sample.

Debriefing sessions were held with MoH and WHO officials, who agreed that the situation was severe and that a massive treatment campaign was necessary. However, due to constraints, it appears that no remedial actions will be taken as a result of this survey in the immediate future.

A total of 540 person-days were spent in the Jubba Valley for vector and bilharzia surveys. At the end of Phase II, Dr. Klumpp was in the process of finalizing his report to accompany preliminary data left in Mogadisho with his summary draft report. A final version of his report will be released by ARD early in Phase III.

## Malaria

Under the direction of Dr. Marian Warsame Yusuf of the NUS Faculty of Medicine, the malaria team tested 1,246 children between the ages of two and nine in the Jamaame area. Each child was registered by name, age and sex, with other relevant personal data taken from the mothers. Blood samples were taken from each child and splenic examinations were conducted. Parasite species and densities were determined from stained blood smears. All diagnosed cases were treated with chloroquine over a three-day period following diagnosis. Adults and older children outside the sample were treated if they were diagnosed as positive at the camp clinic.

Of the 1,246 children in the sample, 14.4 percent had palpable spleens, mostly in grade II and III categories according to Hackett's classification system. All but four villages showed hypo- or mesoendemicity of malaria in regards to spleen measurements. Parasite rates correlated well with spleen measurements, thus ensuring that splenic enlargement was primarily due to malaria. Of the total sample, 258 children (20.7 percent) tested positive with malaria parasites.

*Plasmodium falciparum* was the most common malaria parasite, with only one village showing a presence of *P. malariae* in 14.3 percent of those cases with malaria infection. An associated entomology survey conducted during the study showed that *Anopheles arabiensis* is the most important mosquito vector of malaria in the sample region. Breeding habitats for this vector were found to be in open wells, borrow pits and seepage pools from irrigation canals.

A total of 357 person-days were spent in the Jubba Valley for this part of the epidemiological survey.

## Anemia Survey

Since RHU was unable to conduct an anemia survey, the JESS team leader sought other options to utilize two Hemocue machines (hemoglobin spectrophotometers) that had been ordered and sent to Somalia. USAID and MNPJVD agreed that it was necessary and desirable for the survey to occur, but JESS could not conduct this survey because local currency budgets developed in October had not foreseen the cancellation by RHU. Funding was just not available for a worthwhile survey, and technical assistance could not be rescheduled.

World Concern, a private voluntary organization (PVO) operating in Luuq and Jilib, indicated a willingness to incorporate an anemia survey in Jilib. Further, they felt that Swedish Church Relief, a PVO operating a primary health center

(PHC) in Bu'aale, would also be interested in assisting with an anemia survey. Concurrence came swiftly from MNPJVD and USAID so that JESS was able to loan two Hemocue machines and 1,000 microcuvettes to World Concern in exchange for data collected in this survey. World Concern plans to have data available by June 1988.

## 5. Water Quality

Recognizing a paucity of water quality data for the Jubba River and the importance of such data for planning agricultural development in there, ARD included a major consultancy in the JESS Phase II work plan. This work, performed by Dr. Jobin of Blue Nile Associates, was successfully completed during Phase II.

Early in Phase II, Dr. Jobin helped JESS come to agreement with the NUS Faculty of Chemistry to assist in conducting a one-year program in water quality sampling and analysis of the Jubba River. This program was designed by Dr. Jobin with the concurrence of ARD project management.

Essentially, the program consisted of monthly water samples taken at five widely spaced sampling sites from Luuq to the estuary and more frequent samples taken during peak flow periods. The Jubba River experiences high salinity peaks during an initial flood surge at the onset of each wet season, thus it was desirable to increase the frequency of testing during these periods. However, since these surges are not predictable by specific date, samples were taken weekly during the most likely months for river floods until salinity began to increase. Thereafter, samples were taken daily until salinity began to decrease once again. During Phase II, 120 water samples were collected from sampling stations in the Jubba River, irrigation drains and dhesheegs within the Jubba Valley. All months except February were included in the sample frame.

During sampling, field measurements were made on temperature, pH, electrical conductivity (EC), turbidity and flow. Attempts at measuring dissolved oxygen were made, but high turbidity precluded accuracy in this measurement. Samples were taken to NUS Faculty of Chemistry laboratories and analyzed for numerous chemical parameters, including EC, chlorides, total dissolved solids (TDS), suspended solids and ionic balances. Analyses were completed before September 1987 and data were summarized in a concluding water quality report by Dr. Jobin.

In the United States, Dr. Jobin prepared computerized river and reservoir models for water quality. Models were refined and run, with the results appearing in Dr. Jobin's draft final report on water quality. In this reporting retrospect, ARD is obliged to note an element of luck, but with mention that water quality

teams were adequately trained, equipped and were in position to take optimal advantage of good fortune. Water quality field teams were on site with Dr. Jobin when the Jubba River was in its minimum-flow stage into the estuary during a high-tide event. In fact, the river ceased flow at Kamsuma Bridge, just upstream of the estuary, and tide levels forced saline water to its maximum upstream point, completely inundating domestic water intakes for Kismaayo. Further, water quality field teams were at Baardheere during two separate flood events in the same season and were able to take daily measurements that caught the beginning of a saline peak on both occasions. With this upstream good fortune, water quality teams were subsequently dispatched to measure this surge at downstream locations, thus allowing for relatively precise time-lag calculations.

Approximately 570 person-days were spent in the field with JESS and Faculty of Chemistry personnel for water quality studies. This figure is a rough approximation, as Dr. Jobin also used field time for public health issues. For reporting purposes, Dr. Jobin's field time was split equally between water quality and public health, while staff from the Faculty of Chemistry were assigned full-time for water quality, as were cooks and drivers.

In a memo to the JESS team leader, Dr. Jobin was effusive in praise for the work completed by the Faculty of Chemistry during the reporting period. The JESS record for water quality is the longest record of water quality sampling at multiple sites for the Jubba River. Combined with longer term records maintained by the Jubba Sugar Estates at Mareerey, this JESS contribution to a water quality data base for the Jubba River constitutes an invaluable resource for agricultural development planning in the Jubba Valley.

## 6. Hydrology, Sedimentation and River Scour

Since the Jubba River had been studied hydrologically by two separate organizations (Electroconsult and AHT), ARD planned to send a hydrology consultant to Somalia to review both data sets and to prepare preliminary water balance models based on available data. It was intended that this same consultant address issues of sedimentation and river scour in addition to hydrological studies. ARD also proposed to collect river bed samples to contribute to knowledge on bed-load portions of sediments.

ARD hydrology consultant, Dr. Donald Alford, came to Somalia in January 1987 for a consultancy of two months to consider issues in hydrology, sedimentation and river scour. During his time in Somalia, Dr. Alford carefully reviewed and evaluated hydrology data prepared by Electroconsult (ELC) dam design

engineers and AHT. Dr. Alford made two visits to northern and southern sections of the Jubba River to evaluate sedimentation and river scour potentials.

In his hydrology review, Dr. Alford calculated that estimates of potential reservoir inflow were overly optimistic by as much as 15 percent. This observation created a need for extensive review of his report by JESS and MNPJVD before release by ARD. Based on the draft report, AHT chose to review hydrology data and came to a preliminary conclusion that substantiates, in part, Dr. Alford's observations of optimistic inflow estimates. Subsequently, AHT programmed five person-months for hydrology studies and water balance models. To avoid duplication of effort, ARD did not program additional consultancies for hydrology.

In regards to sedimentation, Dr. Alford was unable to develop definite conclusions owing to a lack of data. His primary conclusion in this area was to urge systematic, long-duration sediment sampling with an integrated sediment sampler. ARD carefully considered working this recommendation into work plans, but ultimately decided to forgo sediment studies owing to time constraints and current security precautions near the most suitable sampling sites. The most likely sites would have been bridges at Baardheere and Luuq, where security is quite intense. JESS pursued sampling options with the National University of Somalia, Faculty of Geology, but without success. It is hoped that future engineering studies for dam design will include a systematic sampling regime for suspended sediments and bed load capacities.

Dr. Alford made rudimentary field observations for river scour potentials and calculation of river flow energy. On the basis of his observations and calculations, he did not find river scour to be an important consideration after the dam, as originally designed, is completed. This subject is currently under review by experts on the AHT master planning team.

## 7. Fisheries

In the Phase II work plan, ARD designed a two phase study of river fisheries set for late Xagaa, a dry season, and at a point between Jiilaal and Gu', dry and wet seasons respectively. In the initial survey, a consultant would assess the current levels of fishing, types of fishing gears, and catch per level of effort by fishermen in the Jubba River, irrigation drains and dhesheegs. The consultant would also attempt experimental fishing and make an effort to tag fish for migration studies.

In a second consultancy, experimental fishing was to have been increased, utilizing chemo-fishing and nets found to be

effective during the first consultancy. Recovery of tagged specimens would have provided a minimum amount of information regarding migration patterns.

ARD selected Mr. Earl Meredith as the JESS fisheries consultant. Mr. Meredith conducted two two-month surveys of Jubba River fisheries. His first consultancy concluded in November 1986 and his second ended in May 1987. In both consultancies, Mr. Meredith was ably assisted by Mr. Ahmed Abdulaahi Yassin, a fishery scientist with MFMR, and counterparts from the JESS staff. Mr. Yassin carried out further fisheries studies for JESS during periods when Mr. Meredith was out of Somalia.

During his first consultancy, Mr. Meredith completed a frame survey, conducted fishing gear assessments and began fish biology sampling. In his first consultant's report, Mr. Meredith estimated that the Jubba River could sustain an annual harvest of 1,600 to 1,800 metric tons of freshwater fish, valued at approximately US\$1 million. His analyses indicated that the Jubba River fishery resource was underexploited.

Because of time constraints and the short period between consultancies, Mr. Meredith concluded that it would not be cost-effective or instructive to conduct a tagging operation in the Jubba River. During floods, fish migrations are more likely to be lateral rather than longitudinal. Fish spill over into dhesheegs, which may be major breeding areas. Relatively large volumes of fish are taken from dhesheegs as they begin to dry from evaporation and seepage. However, it is virtually impossible to measure this movement under present conditions in the valley. River floods are too powerful to allow safe boat movements, and roads are usually impassable during this period.

In his second consultancy, during April and May 1987, Mr. Meredith continued fish biology sampling, but was severely hampered by rising river flows, and chemo-fishing had to be restricted. During this consultancy, the Jubba River experienced a one-in-one-hundred-year flood which curtailed fishing experiments on the river. Mr. Meredith put his time to good use by making comparative assessments of fishing in the Shabeelle River, which was not in flood, and the Jubba River. In total, approximately 120 person-days were spent in the Jubba Valley for fisheries research.

Also during Phase II, Mr. Ahmed Abdulaahi Yassin used JESS boats and fishing gear to conduct further fisheries studies in Jowhar Reservoir and in the lower Jubba River. By establishing cooperative groups of fishermen at each site, MFMR has been able to collect valuable data on Somali freshwater fisheries.

Acting on a recommendation from the mid-term evaluation, ARD sent Mr. Meredith to Kenya to observe and evaluate fisheries created in Tana River impoundments. On his return to the United States, Mr. Meredith visited the UN Food and Agriculture Organization (FAO) to discuss Jubba River fisheries with Mr. Robin Welcomme, an expert on African inland fisheries.

## 8. Limnology

In preparing the Phase II work plan, ARD separated study efforts for reservoir and estuarine ecology. However, as Phase II studies progressed, coverage was being extended into estuarine and proposed reservoir areas through water quality and fisheries components of JESS activities. In the Phase II work plan, ARD planned to send a limnological consultant to Somalia to work on reservoir ecology. At the field level, it was decided to contract two limnologists to study the entire length of the Jubba River. This decision was reached on the basis that there had been no previous limnological surveys of the river, and to restrict studies to a proposed reservoir zone would have been out of order.

This limnological consultancy was planned for May or June 1987 when river flows would normally be receding. In 1987, Gu' rains were delayed, and flooding started in late May and continued through June. Fortunately, the JESS limnological consultants were able to delay their arrival in Somalia.

In August, ARD sent Drs. Steven Njuguna and Francis Muthuri to Somalia to conduct limnological studies of the Jubba River. River levels were still high in August, which affected aquatic populations and sampling strategies. The study team encountered considerable difficulties in access, once becoming mired in mud for two days with their four-wheel-drive truck. Further, JESS boats were performing relief work at refugee camps near Luuq, transporting refugees to flooded fields to rescue irrigation pumps and to salvage what crop residues remained.

The limnologists were assisted by JESS counterpart staff and, in part, by Mr. Ahmed Abdulaahi Yassin from MFMR. As boats were unavailable for sampling, Drs. Njuguna and Muthuri were restricted in their ability to collect aquatic samples. Samples were taken from the estuary, a lower Jubba dhesheeg, middle Jubba River, Baardheere, Buurdhuubo and Luuq. A plan to sample from Jilib to Baardheere had to be aborted when roads became impassable owing to unexpected Xagaa rains in the Middle Jubba Valley.

The report from this survey noted low diversity in phytoplankton, zooplankton, benthic organisms and macrophytes. This low diversity may be a result of two unusual river

conditions that preceded the fieldwork. In early June, the Jubba River experienced unusually heavy floods, which may have scoured many benthic organisms and macrophytes. The large volume of water added to dilution factors for aquatic microorganisms. In addition, water quality data showed relatively high levels of arsenic in the Jubba River in May and June, which may have had deleterious effects on plankton populations. Unfortunately, analysis of water samples taken during this period had not been completed for trace elements and the limnologists were unaware of the elevated and dangerous arsenic levels. Since this JESS survey was the first limnological study of the Jubba River, there are no previous records to use for comparison, and follow-up studies had not been planned or budgeted by ARD.

Unlike many African rivers, the Jubba River does not have a dramatic estuarine zone, nor extensive delta formation. Mangroves are nearly absent, being restricted to a small patch of several hectares on the left bank. In addition, river flow ceases during parts of Jiilaal, permitting a flush of seawater 15 to 20 kilometers inland. These factors contribute to a relatively impoverished estuary when compared to other African rivers. This situation is amply demonstrated by data collected during the limnological survey.

## 9. Forestry

Based on surveys conducted in Phase I, ARD did not share concerns expressed in the project paper and contract with regard to Jubba Valley forests. Far from being degraded and impoverished, JESS personnel found forest resources in the valley to be in a healthy state and not overexploited except in certain restricted areas. Further, terrestrial baseline studies were designed to measure short-term change and vigor of wooded plots. As a result of Phase I findings and baseline study design, ARD planned only one month for a forestry consultant during the late Gu' season in 1987. This consultancy was also postponed due to floods in the Xagaa season.

In September 1987, ARD forestry consultant, Dr. Timothy Synnott, arrived in Somalia to conduct a one-month survey of forest resources and management practices in the Jubba Valley. After discussing his proposed activities with the JESS ecologist, the British Forestry Project and the AHT master planning team, Dr. Synnott went to the Jubba Valley with a JESS assistant, a cook and a driver. This team began at Luuq and traversed the length of the valley to Kismaayo, evaluating forest resources and examining various uses of forest products by valley residents. Dr. Synnott visited National Range Agency (NRA) nurseries in each district and talked with District Forestry Officers.

At his debriefings at MNPJVD and USAID and in his draft report, Dr. Synnott perceived that the forest resource in the Jubba Valley was not overexploited and is in a healthy condition, except around areas of high human densities, such as refugee camps and large agricultural projects, thus supporting findings of JESS Phase I. He was encouraged by increasing agroforestry activities and the capabilities of the technical forestry personnel. He did note a serious diminution of tall forest (basically riverine forest), hence a lack of sawtimber for construction and carpentry. During his fieldwork, Dr. Synnott visited forest preserves in the Jubba Valley and noted a need for immediate protection if these preserves are to remain a viable option for forest conservation areas.

#### 10. Botany

In preparing the Phase II work plan, ARD recognized the unique quality of Somali flora by planning for two consultancies by a botanical expert with extensive experience in Somalia. Primarily, this consultant was not expected to conduct specific studies, but to assist the JESS ecologist in taxonomy of Somali flora.

Mr. Christopher Hemming, ARD botanical consultant, made two Phase II contributions to JESS studies in 1986 and 1987. During each trip, he assisted the JESS ecologist in establishing vegetation monitoring plots in the Jubba Valley. Mr. Hemming also assisted in plant collecting and helped make arrangements for taxonomic assistance from the East African Herbarium in Nairobi, Kenya, and the Royal Botanic Garden at Kew, United Kingdom. Ms. Christine Kabue provided taxonomic expertise with specimens of Gramineae and Cyperaceae, while J. B. Gillett provided assistance with other specimens.

During the first consultancy, Dr. Deshmukh and Mr. Hemming established vegetation plots and collected botanical specimens in the Middle Jubba Valley. A total of 90 vegetation plots were established during this one-month consultancy and 265 plant specimens were collected. Where possible, duplicate specimens were collected for the following herbaria:

- Royal Botanic Garden, Kew;
- East African Herbarium, Nairobi;
- Somali National Herbarium, Mogadisho; and
- National Range Agency, Mogadisho.

During the second consultancy, Mr. Hemming and Dr. Deshmukh performed a botanical reconnaissance of the proposed impoundment

area. The team collected 119 plant specimens in multiple collections for cooperating organizations in Somalia, Kenya and the United Kingdom. At the close of Phase II, one specimen of Cyperaceae (sedges) had not been positively identified and may be a new botanical record. Approximately 225 person-days in the field for these surveys have been incorporated into the TEBS field estimates.

During the botanical surveys, a special emphasis was placed on ethnobotany. This interest was maintained throughout the terrestrial ecology studies. Local informants were asked to provide local names for plant specimens and describe various uses of plants and plant parts. Further, parts of the SEBS work relate to local uses and value of numerous plants.

### 11. Wildlife

JESS Phase II studies did not emphasize systematic study of wildlife populations in the Jubba Valley. An agreement between ARD and the Somali Research Project of University College of London provided some financial support for a two-month biological survey in the Middle Jubba Region. The JESS ecologist worked closely with the five-person team of biologists during its study in 1986. A final report from this team is forthcoming.

During 1987, JESS continued to collect anecdotal information on Jubba Valley wildlife. This information is collected in the SEBS and TEBS surveys, as well as from consultant reports. RMR aerial surveys also provide valuable quantitative data on large mammals and crocodiles.

JESS provided logistical support with equipment, vehicles and staff for a short survey of hunting groups in the Lower Jubba Valley by Ms. Nanny Carder, University of Georgia Department of Anthropology, and Mr. Curtis Marean, University of California, Berkeley. Their reports provided JESS with useful insights on wildlife presence and relative abundance, as well as describing local hunting customs and preferences.

### 12. Ornithology

In the Phase II work plan, ARD planned on sending an ornithologist to Somalia in March to determine relative abundance of water birds and to investigate the role of the Lower Jubba Valley as a passageway for Palearctic migrants. Provision was also made to allow a return of this expert in November if further investigation was warranted.

In March 1987, ARD ornithology consultant, Dr. David Pearson, came to Somalia to conduct a bird survey in the Jubba

Valley, concentrating on Palearctic migratory species. He spent three weeks on this survey with three JESS staff members, recording 270 species between Bu'aale and Kismaayo. No rare or endangered species were encountered, although Dr. Pearson added 13 new records for the Jubba Valley. Approximately 60 field days were spent on this survey.

On the recommendation of Dr. Pearson, it was decided that he should return to Somalia at a time when water was more abundant. Consequently, Dr. Pearson returned for two weeks to repeat his initial survey so as to record changes. During this consultancy, 43 more species were recorded for a combined total of 313 species. It is important to note that previous long-term studies indicated only 380 species had been reported in all of Somalia (Ash and Miskell 1983). Dr. Pearson observed 13 species that had not been previously recorded in the Jubba Valley and five species not previously recorded in Somalia. The JESS team leader prepared a list of all species observed by Dr. Pearson by bird families and presented a copy of this list to the Somali Ecological Society.

From his surveys, Dr. Pearson concluded that the Lower Jubba Valley is an important site for water birds, but it is not an important migratory passageway for Palearctic species. He also felt that the present use of habitat by birds would not be compromised by either dam construction or increased agriculture in that most birds were favored by irrigation projects. Further, he speculated that a large reservoir would provide additional habitat for wading birds, migrants and water birds.

A total of 24 person-days were spent in the Jubba Valley during this second consultancy.

### 13. Pastoralism

In ARD's Phase II work plan for JESS, it was envisioned that a consultant on pastoralism would spend three months in Somalia to study livestock concentrations and pastoral movements into and within the Jubba Valley during Jiilaal 1987. In January 1988, ARD sent Dr. Jorg Janzen to Somalia for two months to conduct a pastoralism study. Since Dr. Janzen had been a serious student of Somali pastoralism for many years, a two-month consultancy was deemed sufficient.

In order to optimize Dr. Janzen's fieldwork, ARD engaged RMR to provide Dr. Janzen with two aerial overflights of the Jubba Valley and adjacent areas to locate major herd concentrations and to mark likely watering sites along suspected migration routes. These two flights in RMR's slow-flying Super Cub provided an excellent platform for overall observations and Dr. Janzen did

not have to spend unnecessary time searching for nomadic pastoralists using his field vehicle.

Dr. Janzen and his team of three JESS assistants spent three weeks covering the area west of the Jubba River in Somalia between the international borders of Ethiopia and Kenya and Kismaayo. The team interviewed pastoralists at market centers and watering sites while noting typical herd compositions.

After resting and gathering provisions in Mogadisho for a few days, the team covered the area east of the Jubba River during a two-week field trip, utilizing the same methods as in the previous trip. The team also included parts of the Bay Region because many pastoralists from this area use the Jubba Valley for grazing and watering livestock, especially during the dry Jiilaal season. Dr. Janzen's team covered the eastern side of the Jubba Valley down to Shabeelle swamps and the inter-riverine area.

In terms of preliminary findings, Dr. Janzen noted many interesting changes in pastoral livestock migration routes. He noted that, generally, pastoralists do not cross the Jubba River, except in a west to east direction in the vicinity of Baardheere. Basically, movements are north to south during dry seasons, returning south to north as rains appear, but without significant river crossings. Herders in Gedo Region move toward Afmadow during Jiilaal, and Bay Region herders east of the Jubba River move southward toward Shabeelle swamps. Each side of the river supports large grazing areas of relatively well-drained sandy soils which are used during wet seasons.

Dr. Janzen noted a change in movement routes and herd concentrations caused by government and donor agency construction of tubewells and man-made water-storage ponds (wars). He also noted an increase of privately owned wars on both sides of the river.

Government abolition of tribal boundaries and nationalization of land have also contributed to changes in livestock movement patterns. Herders are now moving with free access into areas formerly restricted by traditional agreements, causing a large influx of camels into an area formerly used almost exclusively by cattle.

As has been demonstrated by a preliminary review of SEBS data, Dr. Janzen received numerous statements of concern regarding diminishing livestock access to the Jubba River. This concern is especially acute in the Lower Jubba Valley where large state-owned agricultural projects have shut off access to long stretches of riverbank access.

#### 14. Land Tenure Studies

ARD anticipated problems in changing land tenure and land speculation that are common to African dam projects during submission of the JESS proposal. As a result, Dr. James Riddell of the University of Wisconsin's Land Tenure Center assisted in Phase I scoping of land tenure studies in Phase II. Dr. Riddell recommended that ARD include a two-month land tenure study during Xagaa in 1987. This recommendation was incorporated into the Phase II work plan.

During July and August, Dr. Riddell conducted three field trips to the Jubba Valley to study land tenure issues. He was assisted by JESS counterparts and a colleague from the Somali Academy of Science. Dr. Riddell interviewed 90 landowners between Baardheere and Kismaayo. Approximately 200 person-days in the field were used for this survey.

Dr. Riddell's preliminary findings were that land tenure issues do not constitute a serious problem in the Jubba Valley at present, but this situation could change rapidly with an accelerated pace of development. His findings did not concur with earlier studies, conducted before World War II, indicating recent changes in social structures of the valley. In addition, Dr. Riddell's research revealed evidence of increasing land speculation, particularly in the Middle Jubba Valley. More important, Dr. Riddell felt that current land legislation in Somalia constitutes a sound base for equitable and secure land tenure with slight modifications. He feels that the land law must be amended to address risk aversion strategies of valley farmers through the use of multiple farm plots. Under present law, farmers are only able to register one plot. Second, Dr. Riddell feels that a simpler, decentralized registration system would be more effective and more equitable for smallholders.

In addition, JESS has an agreement with LTC concerning land tenure work in the Middle Jubba Valley being conducted by Ms. Catherine Besteman. Ms. Besteman has established a close liaison with JESS team members and will author a land tenure report for JESS. This work will provide many refinements to the overall study by Dr. Riddell.

#### 15. Cultural Heritage

Despite a near oversight regarding cultural heritage studies in the project paper and JESS contract, ARD designed a major study for cultural heritage reconnaissance in the proposed reservoir zone. This study was planned in two stages, consisting of an initial one-month visit in 1986 for scoping and planning a larger study in 1987.

In September, 1986, Dr. Steven Brandt of the University of Georgia and Mr. Thomas Gresham from Southeastern Archeological Services came to Somalia for one month for the scoping and planning tasks. During this period, a plan for a more extensive survey was designed for Xagaa 1987.

In late August, ARD sent an advance party of the cultural heritage survey team to Somalia to begin preparations for an extensive cultural heritage reconnaissance of the proposed inundation area. Mr. Gresham, team co-director, and his wife, Ms. Gisela Gresham, spent an intense week of preparatory activities in Somalia, prior to the arrival of other team members. Besides accumulating field supplies and equipment in Mogadisho, the Greshams went to Buurdhuubo, Garba Haarey and Baardheere to locate base camps and to rent six camels and drivers for the expedition.

Co-director Dr. Brandt, Ms. Nanny Carder, Mr. Rob Benson, Mr. James Ellison and Mr. Curtis Marean arrived a week later to complete pre-trip activities. The team, assisted by JESS enumerators, drivers and cooks, embarked for Baardheere three days later to begin fieldwork. The plan for reconnaissance consisted of establishing a base camp at Buurdhuubo for fieldwork in the central area of the reservoir. Two other teams left Baardheere, one on each side of the Jubba River, for a walking reconnaissance of the reservoir gorge area between the dam site and Buurdhuubo. Each team consisted of two expatriates, two JESS assistants, three camels, two camel drivers, a cook and two camp assistants, plus one police officer for protection.

After 20 days, the teams met at Buurdhuubo and returned to Mogadisho to rest and replenish supplies. After four days, the groups returned to Buurdhuubo with the camel teams heading north toward Luuq and the central team continuing work around Buurdhuubo. Two volunteers, Ms. Sandy Whitney and Ms. Wendy Rogers, joined the cultural heritage team at this time. In 19 days, the teams met at Luuq and returned to Mogadisho several kilograms lighter, but none the worse for wear.

In the 435 person-days in the field, the team investigated 699 sites, mostly archeological scatters of middle and late stone-age artifacts. Other sites included cairns, burial areas and caves, some of which contained unusual rock art. At a debriefing at USAID, the team described the expedition, discussed preliminary findings and exhibited selected samples of artifacts. Co-directors Brandt and Gresham noted that this was the first archeological reconnaissance carried out in the Jubba Valley and was, perhaps, the first archeological survey sponsored by USAID. Since the 699 sites only represent a sample of sites in this area, the team recommends further archeological surveys, including excavation of the most likely sites, before flooding occurs.

JESS is collaborating with Mr. Ken Menkhaus, a Fulbright scholar, in the study of the development history of the Lower Jubba Valley. Through a program of interviews with village elders and reviewing limited written accounts, Mr. Menkhaus is compiling a chronological history dating back earlier than British and Italian occupations, and intends to discuss changes in the economic development of the region to the near present. JESS is collaborating in technical, administrative and logistical support.

#### 16. Upper Watershed Performance

Data on the Ethiopian catchment area of the Jubba River are not available. This highland area supplies up to 97 percent of the total flow (at the Luuq gauging station) that will contribute to the proposed reservoir. During preparation of Phase II work plan, ARD saw the need to establish a mechanism to monitor precipitation in the upper watershed and predict flows into the future reservoir--an important aspect of flood control and reservoir operation. In September 1987, ARD contracted Mr. Thomas Hart, remote-sensing consultant, to begin this study in order to predict runoff quantities and travel times from the upper watershed to the site of entrance to the future Baardheere reservoir at Luuq.

The study is using Ethiopian meteorological-station rainfall records as point samples in creating a series of seasonal rainfall "surfaces," which are then electronically superimposed over 15 subcatchments. The result is a water input distribution model for each surfaced time frame. This precipitation input is then reduced by soil field capacities and evapotranspiration estimates to yield predictions on water volumes available for groundwater recharge and surface runoff. The runoff proportion is modified by character of vegetative cover, degree of slope and type of substrate.

The subcatchment outlines are digitized into a geographic information system, using ERDAS software, on grids of 40 to 120 grid cells of 10 square kilometers each. At the grid-cell level, rainfall data are interpolated and modified with respect to vegetation, slope and substrate characteristics. Once water output is calculated for each grid cell, subcatchment strata are used to summarize and compare proportional inflow contributions in the various seasons. The major unknown in this exercise will relate to effects of transmission losses (e.g., on-route riverbed storage, groundwater recharge fluctuations, or off-takes for irrigation and other water uses). These losses must be held constant in the spatial plane, while the "fit" between runoff estimates and measured flows of Jubba discharge at Luuq must be adjusted empirically through time-series analysis.

The calculations of rainfall surfaces (and their volumes) will allow for direct comparison between aerial rainfall maxima and the corresponding flow maxima. However, lag-time estimates will suffer from the dearth of simultaneous, well-distributed daily rainfall data. Isolated events can be used to describe isolated case relationships that show partial solutions at the daily time interval. Comprehensive monthly analyses may yield less precise, but general, solutions by examination of the offsets of several-month trends over a series of yearly iterations. Finally, the detailed physical descriptions of the catchment can refine lag-time estimates using existing theoretical catchment models based on similar environmental conditions.

Important results will include designating key areas as monitoring sample sites for predicting imminent inflow. Lag-time estimates will be vital to the benefit calculations of any feasibility analysis for monitoring. Remote-sensing alternatives to on-site monitoring activities will be examined in light of regional monitoring initiatives, such as FAO/ARTEMIS and UNEP/GEMS/GRID. Thematic data on the Ethiopian catchment will provide a baseline description and data structure for future studies of downstream implications of development interventions (irrigation diversions, reservoirs) in the upper catchment.

At the end of Phase II, data had been collected, digitized and entered into ERDAS software. Six classes of elevation were entered for evapotranspiration calculations, and geomorphology and soil data for 85 different classes were entered with calculated runoff coefficients. Twenty-two classes of vegetation and land use were used in the software grid.

Precipitation data for eight meteorological stations in Ethiopia have been entered and data from four additional stations have been requested and are pending. Discharge data from the Luuq gauging station are being updated and entered into the system. Upon receipt of the remaining precipitation records, data collection and input will be complete. The study is expected to be completed by mid-April 1988 and will be circulated for comments.

While waiting for the pending data, Mr. Hart tested the validity of the model for an area around the Aberdare Mountains in Kenya for which complete data sets are available. The test run proved the efficiency of the rainfall-surfacing process to be used in the JESS study.

## 17. Long-Term Monitoring

As presented in the JuDAS project paper and foreseen in ARD's work plan for JESS Phase II, Mr. Paul Dulin, ARD's home-office natural resources specialist, visited Somalia in July 1987 to begin preliminary investigations into appropriate monitoring schemes. Long-term environmental and socioeconomic monitoring should be an integral part of MNPJVD's responsibilities and activities in order to detect and analyze the impacts of the pending dam project and subsequent valley development. Monitoring will influence decisions that can lead to a more efficient and environmentally sound project execution and to optimal allocation and development of human and natural resources.

In JESS Report No. 20, Mr. Dulin reported that he found only a very limited capability within Somalia for carrying out a monitoring program. This capability focused primarily on the traditional "monitoring" or oversight of project execution as a management tool for quality control. Several past attempts at the creation of monitoring facilities are discussed in this report, but success of these programs was very limited.

Institutional and organizational alternatives being studied for the restructuring of MNPJVD were reviewed. Price-Waterhouse has made the suggestion that a monitoring unit be created within the eventual restructured organization--this is fully supported in Mr. Dulin's report. The report also detailed a tentative list of themes that a monitoring program should consider, given the logistical, funding and skill constraints present in the Somalia context. Final recommendations will be examined during Phase III and made available in the final report for JESS.

#### IV. JESS PHASE III WORK PLAN

As intended from the inception of JESS, the objective of Phase III is to analyze the bulk of information collected during Phase II's 24 months of field data collection. Information generated through data analyses will be synthesized and assessments made concerning potential environmental and socioeconomic effects of proposed development projects. Finally, recommendations appropriate to a Somali context will be made to:

- mitigate or avoid negative impacts of development;
- take full advantage of the potential of human and natural resources in the Jubba Valley in order to optimize and enhance development initiatives; and
- establish a realistic system of long-term environmental and socioeconomic monitoring of Jubba Valley development, using baseline data from JESS and other related investigations (e.g., master plan) as the basis for gauging impacts and detecting changes.

The Phase III work plan is oriented toward production of the JESS final report, which represents the culmination of three years of investigation. This report will consist of two major parts--the executive volume, and technical annexes. The executive volume will be written in laymen's language and intended for decision-makers and policymakers at MNPJVD, the AHT master planning team, and potential donors/lenders of development projects in the Jubba Valley. The executive volume will be succinct (75 to 100 pages) in its synthesis and presentation of the most pertinent analyses, findings and recommendations evolved from JESS' long- and short-term investigations, and considering other investigations, past and present, of development aspects of the Jubba Valley.

The technical annexes to the executive volume will be subdivided by research effort. Each long-term investigation effort (SEBS, TEBS, MARS) by JESS resident field scientists will result in a "stand-alone" volume representing principal findings of two years of field research. These volumes will include recommendations concerning mitigation or enhancement of proposed development activities, each within their respective technical areas. Short-term or intermittent investigations carried out by JESS consultants and subcontractors will also be represented in the technical annexes by their respective research themes, findings and recommendations. A map annex will present a series of medium- and small-scale maps depicting relevant research findings in geographic format. Other products of research, such as data bases, reference materials, photographic materials and

base maps, will be turned over to USAID and MNPJVD for safekeeping, as discussed in later subsections.

A series of issues has been proposed by USAID/REDSO/EA as a good way to focus attention on salient preliminary findings of JESS research. Accordingly, JESS drew up a tentative list of themes for these issues papers and submitted the list to USAID/Somalia and MNPJVD for approval and comment. Issues papers would be presented for discussion in brief seminars. The writing and presentation of issues papers is considered tentative in the Phase III work plan until guidance is received from MNPJVD and USAID.

In the subsections that follow, activities to be developed during Phase III are discussed and outputs (reports) identified. Activities are presented in matrix format at the end of Section IV, including a chronology of execution and assignment of responsibilities for each activity.

#### A. Socioeconomic Baseline Studies

A stand-alone report will be prepared, documenting analyses of SEBS and WBS field surveys. Responsibilities for this report lie primarily with Dr. Kathryn Craven, JESS socioeconomicist, and Dr. James Merryman, JESS anthropologist. WBS input into the overall report will be the responsibility of Dr. Nancy Merryman, JESS anthropologist. The report will consist of comprehensive analyses and interpretation of survey data, and review and excerpting of other relevant literature concerning socioeconomic aspects of the Jubba Valley (including JESS short-term investigation reports). Analyses will focus on the following major issues areas:

- rationale and research methods for SEBS;
- demography and social organization of Jubba Valley populations;
- labor, including availability, distribution and the potential for labor shortages;
- health and nutrition levels of Jubba Valley populations, existence of health-related services, and effects of valley development;
- Jubba Valley production systems, described as agricultural, agro-pastoral or pastoral, and effects of valley development on production strategies and practices;

- tenurial systems for water, land and range, comparing traditional systems with government tenure laws, and changes expected with valley development;
- local institutions and organizations, including type, function and effectiveness, and how they fit into the valley development scheme;
- availability and quality of government social services, with a view of future valley development and its effects; and
- resettlement of 10,000 to 15,000 residents from the future reservoir zone in light of resettlement history in Somalia, and issues of relocation, compensation, land tenure and the resettlement process.

SEBS still requires a great deal of effort in data analysis during Phase III. JESS computer specialist, Mr. Robert Ondrusek, is charged with restructuring the numerous SEBS data files for their configuration and analysis in STATPAC. Analyses have begun for the major issues described above for Gedo and Middle Jubba regions, with analyses for the Lower Jubba Region scheduled closely thereafter.

Analyses are designed by issue area, so scientists can interpret analyses on one issue and write accordingly, while computer analyses continue for the next issue. WBS analysis is being carried out separately by Dr. N. Merryman; results will then be integrated with the issues areas described above.

#### B. Marketing Survey

The stand-alone report on MARS will be handled by Dr. Craven, with assistance from JESS team leader, Dr. Gus Tillman. The report will depend primarily on analyses of results from the survey of four markets in the Jubba Valley (Kismaayo, Jilib, Baardheere, Buurdhuubo). It will cover the following areas:

- rationale and research methods for the study;
- structure of Jubba markets, including produce origin to market flows, market and transport system;
- MARS results, including analyses of price movements of 8 to 10 commodities by month and season, price difference in different markets, supply sources and market flows by region, and farm-gate price compared to market price (by commodity and market);

- current limits to produce marketing, including price controls, taxation, lack of infrastructure and agricultural inputs, and food-aid inputs;
- effects of valley development on production levels and prices because of urban agglomeration, increased/intensified agriculture and improved infrastructure and transportation networks; and
- future monitoring needs for determination of market information in an evolving development climate.

### C. Terrestrial Ecology Baseline Studies

The TEBS stand-alone report will require that various JESS research materials, as yet unpublished, be incorporated into one comprehensive volume. Aspects of vegetation typing, range and forestry land uses, wildlife and vegetation conservation must be ultimately related. Sources include: data bases of information obtained from botanical identification and measurement at 90 ground sites, field maps and data bases generated through six aerial censuses, several land use maps and aerial photographic sets, and consultants' reports on forestry and wildlife inventories.

Dr. Ian Deshmukh, JESS ecologist, is responsible for authoring the TEBS report. He will have assistance from Dr. Tillman in writing land use and wildlife assessments. The following themes will be treated in the report:

- rationale and research methods for TEBS;
- geographic description of the Jubba Valley, including riverine zones, geomorphology, soils, climate and land use;
- vegetation as a dynamic resource, with emphasis on comparing floodplain and non-floodplain types, classes, structure and species composition and their seasonal changes;
- vegetation as land use, noting changes between 1960 and 1987, patterns of use and carrying capacity of range resources by season, use of forest resources (fuel, timber) and biomass assessments, and ethnobotanic descriptions;
- vegetational changes expected with dam and valley development, and future development of range and forest resources;

- wildlife populations and distribution, aerial censuses of larger animals, distribution and status of vegetation reserves and economic potential, and conservation perspectives; and
- vegetation monitoring to detect and assess efforts of dam and valley development--why and how.

TEBS activities have resulted in a large array of research materials, including aerial photography (stereo pairs), oblique aerial and on-ground slide photography, numerous field maps and charts, and data bases on aerial censuses and vegetation monitoring sites. These materials will be reproduced in limited quantities for future environmental and socioeconomic research and monitoring needs.

#### D. Pending Short-Term Investigations

Several short-term investigations that were initiated during Phase II are still pending, in different stages of completion. These studies were described earlier (Section III.D). With the exception of June 1988 follow-up fieldwork on the bilharzia survey (initiated in November 1987), all field research for short-term investigations has been completed. Final reports on several of these studies, however, are still in draft stages (as of 25 March 1988), as indicated in the list on the following page.

<u>Study Topic</u>	<u>Consultants</u>	<u>Status</u>
Public health engineering and water quality	W. Jobin	final edit
Forestry in the Jubba Valley	T. Synnott	final edit
Fisheries in Jubba River and proposed Baardheere Reservoir	E. Meredith	final edit
Land tenure dynamics in Jubba Valley	J. Riddell	final edit
Cultural heritage	S. Brandt, T. Gresham	final edit
Limnology of Jubba River and proposed Baardheere Reservoir	S. Njuguna, F. Muthuri	final edit
Wildlife survey of Middle Jubba Valley	University College of London	draft final
Bilharzia in Lower Jubba Valley (interim report)	R. Klumpp	draft final
Malaria endemicity in Lower Jubba Valley	M. Warsame	draft final
Pastoralism in Jubba Valley	J. Jarzen	draft
Development history of Lower Jubba Valley	K. Menkhaus	draft in preparation
Upper Jubba watershed performance	T. Hart	draft in preparation
Aerial census of Jubba Valley	M. Watson	draft in preparation
Bilharzia in Lower Jubba Valley (final report)	R. Klumpp	pending June fieldwork

Most of these reports will be published in final form and circulated before the end of May 1988, and then included (or excerpted) in the JESS final report.

#### E. Final Report: Executive Volume

The executive volume of the JESS final report is to be written as a stand-alone document containing a succinct review of the principal findings and recommendations of JESS. Dr. Tillman, JESS team leader, will have primary authorship of this volume,

with input provided as needed by each of the other team members and by ARD home-office technical staff.

The executive volume will use JESS research and other available documentation (AHT, USBR, ELC and others) to describe the biophysical and socioeconomic environment of the Jubba Valley in its pre-dam condition. This then creates the baseline from which the effects of dam construction and operation, and subsequent valley development, are interpolated. With development comes a broad range of policy and program needs that should be considered integral to hydroelectric and irrigation schemes. Certain aspects of proposed development will be negative, and measures should be established for their mitigation. Finally, a system for detecting and documenting the changes associated with valley development needs to be established as one of the best tools for ensuring optimal implementation of proposed projects.

The executive volume is meant for decision-makers and policymakers at MNPJVD, the master planning team and development project donors/lenders. Numerous references will be made to the technical annexes that will accompany the executive volume. These annexes will represent the bulk of JESS research. Each long-term baseline study (SEBS, MARS, TEBS) will be represented in a separate annex. Interim reports from JESS intermittent studies (public health and water quality, fisheries, cultural heritage) and short-term investigations will be consolidated into sector-specific annexes.

A map annex will present selected JESS research results in geographic format. In addition, a comprehensive bibliography will be updated from JESS Report No. 2 and included in a separate annex to the executive volume.

#### F. Completion and Publication of Final Report

The draft final report and remaining technical annexes will be written in Somalia and released before 15 August 1988 to a selected readership, including MNPJVD, USAID/Somalia, USAID/REDSO/EA, NAS Jubba panel members, the AHT master planning team, and others to be named by USAID/Somalia. With release of the draft final report, a 30-day comment period will commence and JESS team members will be repatriated and take accumulated leave.

##### 1. Receipt and Addressing of Comments

At the end of the comment period, comments will be received and compiled by the USAID/Somalia JuDAS project manager and by ARD in Burlington. On or about 15 September, JESS team members will be reassembled in Burlington where they will address

comments and prepare their respective sections of the final report and annexes.

ARD home-office personnel and selected expert consultants will also provide professional input and comment in order to improve both technical and editorial quality of the document. Editing and polishing activities will require approximately 45 days (until 31 October).

## 2. Word Processing and Printing

In November, the draft final report will be reviewed by ARD's home-office editorial staff to ensure uniform editorial quality. The document will be word-processed and camera-ready copy produced on a laser printer. Black-and-white photographs and two-color graphs (if needed) will be reproduced for inclusion in the final product. The final copy will then be professionally printed and bound.

## 3. Map Production

A series of maps will be included in a separate map annex. Maps will be of various scales, including 1:200,000, 1:500,000 and 1:1,000,000. ARD has begun discussions with an experienced cartographic firm concerning layout, costs and logistics.

During Mr. Dulin's July 1987 consultancy, the mapping themes necessary for displaying JESS research results were tentatively defined (JESS Report No. 18). At that same time, and in follow-up work, potential base maps were reviewed and collected. AHT produced new base maps at 1:500,000 and 1:200,000 scales for use in its master planning activities. These were found to be of high quality and ARD has been granted permission to use these as the bases for JESS mapping.

In March 1988, the list of map themes was further refined in discussions with JESS staff and AHT personnel. Draft sketches will be completed for return to Burlington for final cartography and reproduction.

## 4. Preparation and Transfer of Baseline Research Materials, Data Bases and Maps

The final report and annexes are intended to provide the technical information on which to base informed decisions concerning development of Baardheere Dam and the Jubba Valley. A broad spectrum of materials--data bases, maps, aerial photography, slides, tabular data and publications--will be used in developing the report. These are, however, too detailed

and/or bulky to reproduce for inclusion in the final report. For this reason, a limited number of "sets" of baseline research materials will be reproduced and located in repositories where they will be available for future research and/or monitoring.

A minimum of three sets are envisioned for reproduction. Tentative locations suggested as repositories include MNPJVD, USAID/Somalia and ARD/Burlington. The three sets may not necessarily include duplicates of all materials, depending on costs and ease of reproduction. Final determination of repository locations and contents of each set will have to be made by USAID/Somalia's JuDAS project manager. Materials that may be selected for these sets include:

<u>Baseline</u>	<u>Material</u>
SEBS, WBS village survey	computerized data bases
TEBS	computerized data bases, aerial photography, field maps, site descriptions
MARS	computerized data bases
Epidemiology, water quality	computerized data bases, tabular data
Upper watershed investigations	computerized data bases, plots, imagery
Characterization of project area	slide sets, photography
Fisheries	data bases, photography
Archeology	field notes, transects, data bases

In all cases, baseline materials will be catalogued, and JESS staff will prepare descriptions and instructions in booklet form to facilitate use.

##### 5. Presentation of Final Report

A tentative date of 5 December 1988 has been set for presentation of the JESS final report in Somalia. A seminar format has been suggested for the presentation. Such a seminar, of one to three days' duration, would be used to present principal findings and recommendations in graphic form using audiovisual aids and referring participants directly to pertinent

sections in their copies of the report. In essence, seminar participants will be given a quick "guided tour" of the report and its contents.

Selected JESS team members will return to Somalia to participate in the seminar. Any questions or requests for clarification concerning research methods and recommendations will be answered, and discussion of the report contents will be encouraged.

The seminar will be organized and participants selected by USAID/Somalia's JudAS project manager in coordination with MNPJVD. It is assumed that invitees, in addition to USAID/Somalia and MNPJVD personnel, will include representatives from various GSDR ministries, the World Bank, USAID/REDSO, NUS, and other development agencies operating in Somalia.

Final decisions regarding organization of the seminar, presentation dates and selection of participants will be made by USAID/Somalia.

The possibility of at least one additional seminar in Washington, D.C., has been mentioned. The aim would be to present the report to interested bilateral, multilateral and conservationist organizations headquartered in the United States.

#### G. Project Management and Administration

Beyond technical writing responsibilities, JESS will be required to begin the process of project close-out, with repatriation of team members and their families tentatively scheduled for 15 August.

##### 1. Inventory and Turnover of Equipment

Equipment and supplies used during the three-year project life will be turned over to USAID/Somalia for transfer to MNPJVD. An end-of-project inventory will be carried out, as required by USAID, for nonexpendable equipment (essentially, those items costing US\$500 or more). The status (e.g., good condition, broken) of each piece of equipment will be detailed. While an effort will be made to inventory equipment formerly purchased and used by USBR, neither JESS nor ARD is responsible for the existence, condition or quantification of such equipment because no updated equipment accounting was ever provided at the time of the USBR team's departure. All USBR equipment in JESS possession will be turned over to USAID accordingly.

In addition, JESS will prepare a list of expendable and incidental equipment and supplies to be turned over to USAID.

Items and quantities will be detailed, and a receipt for expendables will be presented to ARD.

## 2. Layoff of JESS Staff

At the height of Phase II activities, JESS employed a staff of 68 people, including: office staff, enumerators, data entry technicians, field supervisors, drivers, cooks, guards and market surveyors. As field activities began to wind down in January 1988, JESS began to lay off staff on a predetermined schedule. According to Somali labor law, each employee is entitled to one month's vacation and one month of severance pay for each year worked. Several JESS staff members had worked with the project for more than two years.

With the budget cuts imposed by the Ministry of Finance, the layoff schedule had to be accelerated, but without serious damage to project outputs. With GSDR's imposition of price controls in February 1988, the market surveys came to an abrupt end, although it had been planned to continue them until June 1988.

At the end of Phase II, JESS laid off all but three office support staff (secretary, accountant and logistics manager), all but two drivers, all guards except for two at the data center, and all cooks and market surveyors. All enumerators were scheduled to be released by May, except for supervisors who will stay on until June. By good fortune, HFA was able to retain several enumerators for the resettlement study, at the request of MNPJVD.

It is intended to retain the remaining office staff and two drivers until team departure. Obviously, guards at the data center will remain until MNPJVD assumes responsibility for the data center. By June, all JESS employees except those listed above will be released unless some unforeseen changes occur.

## 3. Closeout of Local Accounts and Administration

The budget for local-currency expenditures must be closed out and all required accounting procedures finalized with the DDD. The JESS team leader, his expatriate administrative assistant (Dr. N. Merryman) and Somali staff will work with DDD to finalize JESS accounts. Summary accounting records will be transferred to ARD/Burlington for future audits. Records required by USAID/Somalia and/or DDD will be transferred accordingly. Files pertinent to the management of the project will be transferred to ARD/Burlington. These include correspondence and chronology files, and those needed for technical and administrative reference.

#### 4. Mobilization and Repatriation

JESS expatriate staff members will begin mobilization for repatriation with some two months' anticipation of the 15 August departure date. ARD's travel coordinator/purchasing agent will directly assist JESS staff with arrangements for shipment of personal effects and travel.

Each staff member will ensure that USAID and FSU checkout procedures are followed. Schedules should be worked out with USAID by early July for checkout and repatriation activities.

The JESS team leader will remain in Somalia for one to two weeks after the 15 August departure date to ensure that all obligations of project management and administration have been met. All team members will repatriate to their homes of record and/or take accumulated leave before reassembling in Burlington to finalize the JESS Phase III report on or about 15 September.



NO.	ACTIVITY/SECTION/PRODUCT	M	A	M	J	J	A	S	O	N	D	Responsibility:										
													GUS	IAN	KC	JM	NM	MT	RO	USAID	ARD	
	REPORTING																					
	Monthly report preparation	x	x	x	x	x	x	x	x	x	x	P										
	Quarterly DDD reports		x			x		x				P										
	Phase II report/Phase III work plan	x										S	S	S	S	S	S	S	S	S	P	
	Issues papers:*																					
	--Environmental		x									P										
	--Resettlement				x											P						
	--Range and forestry	x											P									
	--Marketing			x											P							
	--Land tenure (LTC)				x											S	S					
72	--Women in development					x												P				
	Pending short-term reports:																					
	--Public health/water quality (Jobin)		x									S										P
	--Fisheries (Meredith)		x									S										P
	--Land tenure dynamics (Riddell)		x									S			S							P
	--Limnology (Njuguna and Muthuri)		x									S										P
	--Bilharzia (Klumpp)		x			x						S										P
	--Malaria (Warsame Yusuf)		x									S										P
	--Wildlife (Univ. College of London)		x									S										P
	--Pastoralism (Janzen)		x									S	S	S	S							P
	--Economic history (Menkhaus)		x									S		S	S							P
	--Cultural heritage (Brandt)		x									S										P

\*Tentative, depending on MNPJVD decision.

P=principal, S=secondary.



NO.	ACTIVITY/SECTION/PRODUCT	M	A	M	J	J	A	S	O	N	D	/									
													GUS	IAN	KC	JM	NM	MT	RO	USAID	ARF
	--Upper watershed (Hart)			x								S									P
	--Aerial census (Watson)		x									S	S								P
	Organize and transfer resource center vols.						x												P		
	JESS final report:																				
	--Draft executive volume						x					P	S	S	S	S					
	-physical and biological environment											P	S								
	-socioeconomic environment											P	S	S	S	S					
	-effects of Baardheere Dam											P	S	S	S	S					
	-development policy needs											P	S	S	S	S					S
73	-development program needs											P	S	S	S	S					S
	-mitigation of negative devel. effects											P	S	S	S	S					
	-long-term environ./socioecon. monitoring											P	S	S	S	S					S S
	--Exit debrief and draft presentation						x					S	S	S	S	S					P
	--Final executive volume											P	S	S	S	S					S S
	--Final annexes (short-term reports)											S	S	S	S	S					P
	--Map annex											S	S	S	S	S					P
	--Word processing, reproduction																				P
	--Preparation of data bases/research materials											S	P	P	P	P					S
	--Reproduction/transfer of research materials																				S P
	--Comprehensive bibliography											S	S	S	S	S	P				S
	--Final report presentation in Somalia											S	S		S						P S







NO.	ACTIVITY/SECTION/PRODUCT	M A M J J A S O N D												GUS IAN KC JM NM MT RO USAID ARD						
		M	A	M	J	J	A	S	O	N	D	GUS	IAN	KC	JM	NM	MT	RO	USAID	ARD
	DATA PROCESSING/ANALYSES																			
	Socioeconomic Baseline Studies (SEBS):																			
	--Final checking/entry of questionnaires																			
	--Restructure Gedo and Middle Jubba files (III&II)													S	S			P	S	
	--Analyses for Gedo and Middle Jubba Regions (III and II):													S	S					
	-resettlement														S				P	
	-labor															S				P
	-social organization														S					P
	-marketing														S					P
76	-production systems														S					P
	-health and nutrition														S	S				P
	-land tenure														S		S			P
	-government and social services														S					P
	--Restructure Lower Jubba files (I)														S					P
	--Analyses for Lower Jubba Region (I):																		P	P
	-resettlement																			P
	-labor															S				P
	-social organization														S					P
	-marketing														S					P
	-production systems														S					P
	-health and nutrition														S	S				P
															S	S				P







NO.

ACTIVITY/SECTION/PRODUCT

M A M J J A S O N D

GUS IAN KC JM NM MT RO USAID ARD

NO.	ACTIVITY/SECTION/PRODUCT	M	A	M	J	J	A	S	O	N	D	GUS	IAN	KC	JM	NM	MT	RO	USAID	ARD
	PROJECT MANAGEMENT AND ADMINISTRATION																			
	Coordination of office staff											S				P				
	General administration, communications											S				P				
	Payroll and tax payments	X	X	X	X	X						P				S	S			
	ARD disbursements and accounting											S								P
	JESS/DDD disbursements and accounting	X			X	X						P				S	S			
	Somali income and stamp taxes	X			X			X				P								
	Liaison:																			
	--USAID																			
64	--MNPJVD											P							P	S
	--AHT											P							P	
	--LTC											P	S	S	S	S	S	S	S	S
	--Halcrow Fox Associates											P	S	S	S	S				
	Inventory of JESS equipment					X						P	S	S	P	S				
	Equipment transfer						X					S	S	S	S	P	S			S
	Layoff of JESS Somali staff							X				S							P	S
	Turnover of data center							X				P				S	S			
	Return of files to Burlington							X				P				S				
	Vacate MNPJVD offices							X				P				S				S
	Checkout procedures							X				P								
	Expediting of Somali training candidates								X			P	P	P	P	P		S	S	
												S	S	S	S			P	S	



NO.	ACTIVITY/SECTION/PRODUCT	M	A	M	J	J	A	S	O	N	D	GUS	LAN	KC	JM	NM	MT	RO	USAID	ARD	
	International travel/repatriation																				
	--G/M Tillman vacation/work in Nairobi											P									
	--I Deshmukh vacation/work to USA; repatriation												P								S
	--N Merryman vacation to USA ; repatriation															P					S
	--J Merryman vacation to USA ; repatriation																				S
	--G Tillman to Africa River Basin Conference in USA														P						S
	--R Ondrusek on leave/Nairobi; repatriation																				S
	--K Craven repatriation; vacation																				S
	--G/M Tillman repatriation; vacation																				S
08	USAID internal evaluation of JESS											S	S	S	S	S					P

APPENDIX A

Actual Professional Level of Effort Expended in Field Activities  
During Phase II (1 April 1986-31 March 1988)

<u>Long-Term Field Staff</u>	<u>Person-Months of Effort</u>
Fisheries Biologist/Chief of Party <sup>1</sup>	10.00
Environmental Scientist/Chief of Party <sup>2</sup>	14.00
Principal Anthropologist	24.00
Anthropologist/Administrator	24.00
Socioeconomist	24.00
Terrestrial Ecologist	24.00
Data Center Coordinator	<u>8.00</u>
Subtotal	128.00
 <u>Intermittent and Short-Term Investigations</u>	
Hydrology and Sediment Transport	2.00
Water Quality	4.75
Public Health	2.70
Vector/Epidemiology Surveys	8.00
Botany	4.00
Forestry	1.60
Wildlife Inventory/Ornithology	2.00
Computer/Information Management	6.00
Aerial Photography/Census	9.50
Fisheries	3.50
Limnology	2.75
Pastoralism	3.15
Land Tenure	2.50
Cultural Heritage <sup>3</sup>	16.50
Remote Sensing (Upper Watershed Performance)	2.50
Long-Term Monitoring	<u>1.00</u>
Subtotal	72.45
Grand Total	<u>200.45</u>

<sup>1</sup>Departed Somalia in February 1987.

<sup>2</sup>Arrived in Somalia in February 1987.

<sup>3</sup>Includes effort of four graduate students and a Fulbright Scholar.

APPENDIX B

JESS Reports

1. PHASE I REVIEW AND PHASE II WORK PLAN FOR THE JESS PROJECT; 31 July 1986.
2. BIBLIOGRAPHY OF THE JUBBA VALLEY IN SOMALIA FOR THE JESS PROJECT; 31 July 1986.
3. JESS MANPOWER AND TRAINING ASSESSMENT; Richard Z. Donovan; 31 July 1986.
4. JUBBA ENVIRONMENTAL AND SOCIOECONOMIC STUDIES FIRST ANNUAL REPORT; 3 November 1986.
5. JESS INTERIM REPORT ON HEALTH IMPACTS OF DESIGN ALTERNATIVES FOR PROPOSED BAARDHEERE DAM; William R. Jobin; 11 November 1986.
6. JESS INTERIM REPORT ON HEALTH CONSEQUENCES OF DESIGN CRITERIA FOR WATER SUPPLY AND SANITATION IN NEW AND RESETTLED COMMUNITIES; William R. Jobin; 12 November 1986.
7. JESS CONSULTANCY REPORT ON WATER QUALITY AND PUBLIC HEALTH ENGINEERING; William R. Jobin; 20 November 1986.
8. JESS INTERIM REPORT ON CULTURAL HERITAGE SITES IN PROPOSED BAARDHEERE RESERVOIR AREA; Steven A. Brandt; 20 November 1986.
9. INTERIM REPORT ON VEGETATION SURVEY OF THE JUBBA VALLEY; Christopher F. Hemming; October 1986.
10. JESS PHASE I DESIGN STUDIES; William R. Jobin, Peter A. Bloch, James C. Riddell, Curt R. Schneider and James F. Ruff; July 1986.
11. JESS SECOND CONSULTANCY REPORT ON WATER QUALITY AND PUBLIC HEALTH ENGINEERING; William R. Jobin; January 1987.
12. JESS FISHERIES CONSULTANCY I REPORT; Earl K. Meredith; June 1987.
13. JESS INTERIM REPORT ON AERIAL PHOTOGRAPHY INTERPRETATION; Eric Trump; June 1987.
14. JESS PRELIMINARY REPORT ON AERIAL SURVEY OF THE JUBBA RIVER; R. Murray Watson; June 1987.
15. JESS THIRD CONSULTANCY REPORT ON WATER QUALITY AND PUBLIC HEALTH ENGINEERING; William R. Jobin; July 1987.

16. JESS WORKING PAPER: PRE-CONSTRUCTION CONCERNS WITH THE BARDHEERE DAM; R. E. Tillman; November 1987.
17. JESS INTERIM REPORT: RIVERINE FORESTS OF THE JUBBA VALLEY, ISSUES AND RECOMMENDATIONS FOR CONSERVATION; Ian Deshmukh; 17 November 1987.
18. JESS INTERIM REPORT: MAPPING JESS RESEARCH RESULTS; Paul Dulin; 14 October 1987.
19. JESS INTERIM REPORT: SURVEY OF PALEARCTIC MIGRANT BIRDS IN SOMALIA'S MIDDLE AND LOWER JUBBA VALLEY; David Pearson; 23 October 1987.
20. JESS INTERIM REPORT: LONG-TERM ENVIRONMENTAL AND SOCIOECONOMIC MONITORING; Paul Dulin; 26 October 1987.
21. JESS REPORT ON WATER BALANCE AND SEDIMENT TRANSPORT IN THE JUBA RIVER WATERSHED; Donald Alford; 31 August 1987.
22. JESS INTERIM REPORT: DATA MANAGEMENT AND ANALYSIS; Leonard A. Malczynski; 30 November 1987.
23. JESS INTERIM REPORT: SECOND VEGETATION SURVEY OF THE JUBBA VALLEY; Christopher F. Hemming; August 1987.
24. JUBA ENVIRONMENTAL AND SOCIOECONOMIC STUDIES -- SECOND ANNUAL REPORT; 15 December 1987.
25. JESS INTERIM REPORT: SECOND SURVEY OF PALEARCTIC MIGRANT - BIRDS IN SOMALIA'S MIDDLE AND LOWER JUBBA VALLEY; David Pearson; December 1987.
26. JESS REPORT ON CULTURAL HERITAGE SURVEY OF THE PROPOSED BAARDHEERE RESERVOIR; S. A. Brandt and T. H. Gresham, with contributions from N. Carder, J. Ellison and R. Benson; 24 February 1988 (draft).
27. JESS REPORT ON FORESTRY IN THE JUBBA VALLEY; T. J. Synnott; March 1988.
28. JESS REPORT ON BIOLOGICAL LIMNOLOGY OF THE JUBBA RIVER; Steven G. Njuguna and Francis M. Muthuri; 28 March 1988.
29. JESS REPORT ON MALARIA ENDEMICITY IN THE LOWER JUBBA REGION; Marian Warsame Yusuf; 1 April 1988.