Livestock Development and Rangeland Conservation Tools for Central Asia

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Narrative Summary

Political and economic changes in Central Asia resulted in an apparent decline of livestock production, rangeland health and rural family welfare. This project's goal is to improve the welfare of herders, and promote livestock development while enhancing sustainability and conservation of rangeland resources. Rural surveys will identify production-limiting factors and will establish the relation between enterprise characteristics and human nutritional and economic welfare. Technologies to address these limitations will be tested on-farm and evaluated in terms of impacts on human welfare, sustainability, global carbon budget and potential for adoption. Characterization and modeling of policy and ecological scenarios will allow identification of policy instruments that will promote our goal.

The project, which focuses on Kazakstan, Uzbekistan and Turkmenistan, was organized in a series of modules. Each module has a leader and produces results that stand alone, whereas the integration of these results will lead to recommendations both at the policy and farm level. The Basic Resources module generates a GIS for integration, modeling, and extrapolation of information. The Forage Production and Carbon Dioxide module studies the role of rangelands on the global C budget, and will produce empirical coefficients to model rangeland forage production under risk. The Animal Production and Technological Alternatives modules will model and test existing and new options for sustainable livestock production. A Human Nutrition component will establish the relation between livestock production system, diet and health. Finally, the Socio-Economic module conceptually integrates all information to model potential impacts of different policies.

During 1997-98 we focused on deployment of research capacity, completion of the GIS for Kazakstan, measurement of CO_2 fluxes in three ecological zones, and rural surveys in Kazakstan. Deployment of research capacity involved the shipping and installation of voluminous field equipment, and training of regional scientists. The basic GIS for Kazakstan has been completed, including a detailed map of rangeland and the corresponding database. The research capacity and the GIS created by our project were used to prepare maps for and support the National Environmental Action Plan of Kazakstan. Forage productivity, weather and CO_2 flux data for the current growing season were collected successfully at Karrykul in Turkmenistan, Shortandi in Kazakstan, and Karnab in Uzbekistan. A formal survey of rural households and agricultural enterprises was designed, pretested, and conducted in Kazakstan. Besides serving as a baseline to assess future impacts and providing the data for model development, surveys are the basis for two MS thesis and a Ph.D. dissertation, and directly reached 270 rural households in three ecological regions of Kazakstan. In preparation to produce longer-term policy impacts, our team incorporated representatives appointed by the Ministry of Ecology of Kazakstan, Ministry of Nature Use and Environmental Protection of Turkmenistan, and the Association of Livestock Breeding of Turkmenistan. Appointments by the Ministry of

Agriculture and the Agency for Central Planning and Reform of Kazakstan are pending.

In the next two years we plan to extend the survey and GIS work to Turkmenistan and Uzbekistan. Concurrently, GIS modeling and on-farm experimentation will start in Kazakstan. Reviews of agricultural policies and technologies will be conducted in all three countries.

Research

Problem Statement

Recent market changes and privatization caused imbalances and dramatic reductions of agricultural stocks, production and productivity in some Central Asian Republics (CAR). Sustainability of extensive production and human nutritional welfare were negatively impacted. Division of state and collective herds into smaller private units caused erosion of animal stocks that started in the early 1990's and is in contrast with the long-term increase of livestock population in the region. The decline in livestock numbers can be attributed to the deterioration of the terms of trade for producers. Lack of affordable, good quality winter forages, temporary collapse of marketing networks, and poor maintenance of livestock water wells appear to have resulted in greater pressure on range plants used for feed and fuel, and greater concentration of livestock around populated areas and active wells. In spite of declining livestock numbers in Kazakstan, rangeland degradation is reportedly accelerating in some areas, whereas remote areas are no longer grazed. Rangelands of CAR may constitute a significant part of the "missing sink" that attenuates the increase in atmospheric carbon dioxide. Thus, there is an immediate need to improve welfare of small land owners, and to prevent further deterioration of rangelands.

Approach

We take an integrated multidisciplinary approach to improve the welfare of herders that involves not only on-farm testing of technical aspects, but also the assessment of alternatives and policy instruments to support them. Alternatives will be evaluated from the point of view of human welfare, sustainability, impacts on the globalcarbon budget, and economic profits. A GIS model incorporating ecological and policy scenarios will be used to explore the regional impacts of various technical alternatives. Connections among research and development modules on basic resources, rangeland forages, animal production, technological alternatives, socio-economic integration and policy, and human nutrition, are depicted in Figure 1.

Figure 1. Relationships between and integration of the different components of the LDRCT project. Different arrows indicate different stages of the project.

First Year Activities

Main activities proposed for the first year (1997-98) were classified into four categories: deployment of research capacity, completion of GIS for Kazakstan, measurement of carbon dioxide flux in rangelands, and rural surveys of human welfare and production systems in small private farms. As detailed in the following sections of this report, all of these activities were performed with a high level of success.

- Installation of research capacity involved the selection of two new research sites (one in Kazakstan and one in Turkmenistan), in addition to the first one established in the Karnab district of Uzbekistan by ICARDA and ARS-USDA, purchase,

shipping and installation of Bowen-ratio equipment and computers in the two sites, and hiring and training of scientist and personnel who will maintain equipment and operate the CO_2 measurements. In addition, the Animal Husbandry Institute of Turkmenistan and the University of Samarkand will be equipped with GIS computers and software, and will be linked to the internet.

- Completion of the GIS for Kazakstan that was started during the assessment year included proofing the layers, translation of the database to English, and preliminary documentation of forage production.
- CO_2 flux data were collected and summarized for the 1998 growing season in Kazakstan, Turkmenistan
- and Uzbekistan. Data are being used to parameterize empirical range productivity models in conjunction with the GIS.
- A formal rural survey was conducted in Kazakstan. Ninety households were interviewed in each of three regions. Data was collected to describe main features of production systems, including quantification of land, labor and capital. Nutrition and health of humans was assessed in relation to diet quality and quantity. Data was analyzed to determine the link between human nutrition and livestock systems.

Deployment of Research Capacity

Basic Resources and GIS (BR)

A plan of action was developed with the Institute of Desert, Flora and Fauna of Turkmenistan for the development of a GIS for this country. Trained personnel were identified, and a GIS computer system was purchased for this work.

Range Forage Capacity and CO_2 (RF)

Lead investigators from the U.S. traveled to Central Asia during 1997 and 1998 to identify cooperating scientists and evaluate possible research sites. Research sites were established in Uzbekistan (Karnab Site, Dr. Mukhtar Nasyrov), Turkmenistan (Karrykul Site, Drs. Dourikov and Gedemov), and Kazakstan (Shortandy Site, Dr. Kanat Akshalov). Bowen ratio equipment and computers were ordered, cleared through customs, and delivered to the lead institutions in each of the three countries. Dr. Nasyrov was brought to the U.S. for a two-month training period to become familiar with the Bowen ratio equipment and data processing techniques. Dr. Saliendra traveled to Uzbekistan to install the Bowen ratio equipment at the Karrykul site on 4 March 1998. Drs. Saliendra and Nasyrov subsequently traveled to Shortandy, Kazakstan and Karrykul, Turkmenistan to install the Bowen ratio equipment on 16 May and 26 May 1998, respectively. While in Kazakstan and Turkmenistan, Drs. Saliendra and Nasyrov also provided on-site training in the operation, maintenance, and trouble-shooting of the Bowen ratio equipment and in processing the Bowen ratio data. Work proceeded as planned with no modifications.

Animal Production and Technological Alternatives (AP&TA)

Specific objectives and plans of action have been developed with the Turkmenmallary Association of Livestock Producers of Turkmenistan (former Institute of Animal Husbandry), and the Institute of Pasture and Fodder of Kazakstan. Drs. O. Hodjakov and O. Soyunova are currently preparing the following products: (1) a compilation of agricultural statistics at the raion (district) level for the years 1975-1996, including the following information for each year: numbers of livestock separated by kind; raion name and area; production of livestock in terms of wool, meat, milk, etc.; rainfall; area of land cultivated for grains and forages; incidence of livestock diseases; amount of conserved

forages received from other raions; (2) a compilation of agricultural laws and decrees that regulate production of livestock, land tenure and availability of agricultural inputs in Turkmenistan; (3) a description of livestock production systems in Turkmenistan, including a literature review enhanced by opinions of experts, bibliography, descriptions of the current management schemes, grazing methods, types of production (wool, meat, etc.), and annual schedules of livestock management. A computer has been purchased to be used by Drs. Hodjakov and Soyunova for preparing the database that will serve as basis for the reports. A comparable report on forage resources and animal production systems of Kazakstan is being commissioned through ICARDA. A computer system has been purchased for the Institute of Pasture and Fodder of Kazakstan to prepare the necessary database of references and statistics.

GIS for Kazakstan

A computerized geographic information system (GIS) was prepared for Kazakstan in a joint effort by the Institute of Ecology and Sustainable Development (IESD), Kazakstan and the Department of Agronomy and Range Science, University of California at Davis. The GIS consists of a spatial database which currently contains the following information:

Rangeland classification by soil type, vegetation type and productivity

- Elevation
- Precipitation
- Temperature (seasonal maximum and minimum)
- Population of humans and animals
- Location of roads, railways, streams, lakes, cities and oblast boundaries

Information which will be added to the database in the immediate future include the following:

- Solar radiation.
- District (raions) boundaries and location of pertinent villages.
- Remotely sensed data (e.g. NDVI images).

The database currently is in both IDRISI and ArcView formats and can be readily exported into other GIS formats as needed (Figure 2).

Rangeland information was obtained from a map compiled in 1978 by the Complex Prospecting Department of the Institute of Kazgiprozen of the Ministry of Agriculture (within former USSR). This map covered the entire country of Kazakstan at a scale of 1:1,500,000 and was in turn created from several previous mapping sources including materials from Moscow State University. The map was digitized by IESD and is now in digital format. This information will be updated as needed to reflect current rangeland status.

Figure 2: Example of information contained in the GIS. Numbers refer to rangeland types and link each polygon with a database containing detailed descriptions of species, productivity, seasonality, temperatures, rainfall, etc.

Elevation information currently in the database was obtained from the Digital Chart of the World (DCW), created in 1992 by Environmental Systems and Research Institute, Inc. The primary source for the information is the Operational Navigation Chart series produced by the former United States Defense Mapping Agency. The DCW is in a 1:1,000,000 scale and has elevation contours at 1,000 feet intervals. In addition, there are paper maps that have contours at 20 and 50-meter intervals that can be digitized and added

to the database at a later date if deemed necessary. IESD staff prepared the precipitation and temperature layers. Human and animal population was compiled by IESD staff and is currently organized by oblast. This information is based on statistics published in 1996.

Supplemental information including roads, railways, streams, lakes, city locations and oblast boundaries was compiled both by IESD staff from Russian maps and by UCD from the DCW and Russian maps. This information needs to be reconciled and the information which most accurately represents the current status within Kazakstan will be maintained in the computerized database.

The database is currently being cross checked to verify the accuracy of the information. Sources used within the database exist at several different scales and projection systems. The data willeventually be converted to and stored as latitude/longitude coordinates within the World Geodetic System 1984 (WGS84) which is the current global standard. The information can then be projected at whichever system is best suited to the user.

Once the database is satisfactorily georeferenced, users will be able to select a point anywhere within the borders of Kazakstan, and the computer will then report the rangeland information, temperature, mean annual precipitation, etc., for that location. The layers can also be used in predictive modeling since each informational layer can be treated as a variable in a model equation.

Carbon Dioxide Fluxes on Rangelands in Central Asia

Rangelands provide the main source of forage and pasture that feed livestock in Central Asia. Accurate estimates of annual net primary production (ANPP) from these rangelands will provide important information on carrying capacity to sustain livestock production. The main objective of the RF subproject is to quantify ANPP on representative Central Asian rangelands. A secondary objective of the RF subproject is to assess the role of Central Asian rangelands in the global carbon budget. Three study sites were identified for continuous monitoring of CO_2 fluxes using the Bowen ratio technique. In October 1997, an Artemisia diffusa-dominated rangeland site was selected in Karnab, Uzbekistan; in March 1998, two additional sites were identified in Kazakstan and Turkmenistan. A rangeland site dominated by Stipa capillata was chosen at Shortandy, Kazakstan; this site is part of a 200-ha plot that was protected from wheat cultivation. Similarly, a site representative of sandy desert rangelands was selected on a former USSR agro-ecological research station at Karrykul, Turkmenistan. Drs. Nasyrov (Uzbekistan), Akshalov (Kazakstan), and Dourikov (Turkmenistan) were identified as primary scientific collaborators for the RF subproject.

During February-March 1998, Dr. Saliendra traveled to Uzbekistan to provide technical expertise in the installation, downloading and processing of data, maintenance, and trouble-shooting of the Bowen ratio systems. Drs. Gintzburger and Nasyrov plus technical staff of the Karakul Sheep Research Institute at Samarkand installed the Bowen ratio system at the Karnab site on 4 March 1998. During May-June 1998, Drs. Nasyrov and Saliendra installed Bowen ratio equipment at the sites in Shortandy, Kazakstan and Karrykul, Turkmenistan. They also provided on-site technical support training to cooperating scientists in both Kazakstan and Turkmenistan. During his May-June visit, Dr. Saliendra brought three laptop personal computers for use at each of the CO_2 flux sites; E-mail communications were also established at that time. Data collected with the Bowen ratio system (averaged at 20-minute intervals) include vertical gradients (1 m apart) in temperature, CO_2, and water vapor concentration; ambient relative humidity and temperature; wind speed and direction; net radiation; photosynthetically active radiation; volumetric soil moisture content; soil temperature; soil heat flux; and precipitation. Since

installing the three Bowen ratio systems, data have been electronically transferred weekly from each of the three monitoring sites to the USDA-ARS Forage and Range Research Laboratory at Logan, Utah. Weekly Bowen ratio data are routinely evaluated, and collaborators in host countries are immediately advised of any technical problems with the Bowen ratio equipment. These data are processed into five-day periods, and CO_2 fluxes are calculated with a spreadsheet for each 20- minute average, which are subsequently used to obtain daily integrals of CO_2 flux. Monthly Bowen ratio and CO_2 flux data are electronically sent to Dr. Gilmanov at South Dakota State University who develops CO_2 flux models for each site.

Since installation of the Bowen ratio equipment, a wide range of field data have been collected continuously at 20-minute intervals at the three field measurement sites in Central Asia. These data are being routinely transferred electronically to Logan, Utah, where they are processed into five-day segments. Data are evaluated for reliability, and any equipment malfunctions are identified and collaborating scientists notified. The segmented data sets are subsequently used to calculate daily integrals of CO_2 flux. These data are electronically sent to Dr. Gilmanov at South Dakota State University who evaluates the relationships between environmental characteristics and rates of CO_2 flux (Figure 3). These relationships will be used to develop predictive models of CO_2 flux for each site. Work proceeded as planned with no modifications.

Figure 3: Relationships between net CO_2 fluxes and environmental conditions at the foothills rangeland site.

Daytime CO_2 flux in relation to photosynthetically active radiation

Rural Surveys in Kazakstan

Surveys of human nutrition and food security (HN surveys), household livestock production systems (AP surveys), and livestock marketing (LM surveys), took place during July-September 1998. Human nutrition, food security and production systems were surveyed concurrently in three large-scale ecological regions along a transect from Akmola to Almaty. Thus, the HN and AP surveys followed a single sampling plan, and data for both surveys was obtained from each of the 270 households reached. The study of livestock marketing was conducted by Dr. C. Kerven along a transect in western Almaty Oblast. Most of the data collected are still being organized and analyzed. We presently report on activities that led to the successful conduction of surveys, methods used, and preliminary results.

Human Nutrition and Livestock Systems

Several team members were directly involved in the planning and conduction of the HN and AP surveys in Kazakstan. Planning meetings took place in UC Davis during the Fall of 1997 and Winter of 1998, with the participation of Jarvis, Howitt, Grivetti, Plant, Breuer, Carpenter, Laca, and Jose Bervejillo. Carpenter, Breuer and Bervejillo drafted survey forms on the basis of examples and suggestions from the other team members, including Tom Nordblom, from ICARDA. Drafts were reviewed and improved over three iterations. An almost final draft was distributed to collaborators during the annual meeting at Ashgabat in March 1998. Comments from Z. Zhambakin, I. Alimaiev and other team members were incorporated. During his trip to the region in March 1998, E. Laca and other team members visited former state farms, collectives, and herders, to conduct informal interviews. These interviews were used as a basis to determine what information

was available and how the survey forms should be revised further. M. Carpenter and A. Breuer went to Almaty in May and June to establish the organizational infrastructure for the surveys. Drs. A. Aw-Hassan and E. Thomson joined the survey efforts in mid July, and participated in the training of survey team members, pre-testing of procedures, and sampling design. Survey forms were translated to Russian and were further improved on the basis of pre-testing results. Drs. S. Beniwal and M. Suleimenov provided technical and logistical support throughout the survey period.

Surveys to examine household food security were conducted in 270 households along a wide, 500-mile long transect covering three ecological regions, dry steppe in the north, semi-desert in the central region, and foothills in the south (Figure 4). In the central region, the survey took place in three districts (raions) of Karaganda Oblast (Shetsky, Zhanaarkinsky, and Aktogaysky). In the south, the survey included four districts covering two oblasts: Almaty Oblast (Djambul rayon) and Djambul Oblast (Sariysusky, Villages with more than 0.06 sheep units/ha and less than 2000 people were eligible for inclusion in the survey (sheep units refers to any combination of livestock that amounts to a sheep equivalent). Within a village, households had to have more than ten sheep units in order to be included in the survey. Four to six households were surveyed per village, and 15 villages were sampled in each region.

Figure 4: Oblasts and rayons of Kazakhstan included in the rural survey of human nutrition and livestock systems. S, D, and F indicate dry steppe (S), semi-desert (D) and foothill (F) areas surveyed.

Two complete survey forms were filled out for each household, one focusing on human nutrition, and one focusing on the household as an economic and production unit. Data to assess nutritional status and food security of each household was collected through questionnaires about basic demography, Sverdlovsky and Talassky rayons). These sites were selected because they represent three major ecological zones where livestock production is of major importance. The unit of sampling was the household. Peasant farmers were the focus of the survey for two reasons. First, according to reports of local experts, they hold about 80% of the livestock in the country. Second, they have a clearer legal framework and simpler ownership structure than the different forms of co-operatives, which are quite complex and are in a state of transition.

Ninety households were selected randomly in each region. Randomization took place at the district level for selection of villages and at the village level for selection of households, socio-economic status, seasonal food frequency, weaning foods, and home food production and purchases. Hemoglobin levels of women (15-49 years of age) and children (1-7 years) were assessed using a Hemocue and standard finger prick to determine the prevalence of anemia (Hg<120g/L). Height and weight of women and children were measured using a UNICEF mother-child digital scale and standard height board to determine the prevalence of undernutrition, stunting and wasting. Body mass indexes for the women and Z-scores for the children were calculated.

Forms for collecting data on AP included the following sections: (1) labour resources, (2) land and infrastructure, (3) water, (4) agricultural equipment, (5) use of pastures and hay fields, (6) livestock numbers, breeds, health, management calendar, sources and purposes, and marketing (all by species), (7) crop and forage production and transactions. A grazing section in the survey included an assessment of seasonal grazing techniques and requested that villagers describe changes observed in their pastures over time. Coordinates of each household surveyed were determined with hand-held GPS. Thus, village-level evaluations can be matched with information from the GIS, and a comparison of local perspectives and requirements with data on range carrying capacity will be possible. In addition to the survey data, 12 vegetation transects were examined in five villages located within the

foothills of the Dzhambul Oblast. In three villages, three 500-m long transects were surveyed. The transects were located 0.8-1.5, 3-5, and 6-7 km from the edge of each village, along the main grazing routes in use. These distances were selected to assess the impacts of heavy to light use in areas grazed continuously. In the remaining two villages, transects near the villages were evaluated, other transects could not be measured due to the proximity of surrounding villages. Soil condition, and species frequency, height, and % cover were recorded along each transect. These data will allow a quantitative assessment of rangeland condition as a function of distance from village and village characteristics. Preliminary results are reported below.

Preliminary results of human nutrition and livestock surveys

Health Indicators

Overall prevalence of anemia among women was 38% (n=239). Prevalence of mild (10-11.9 g hemoglobin/dl), moderate (7-9.9 g hemoglobin/dl), and severe anemia was 28.0, 9.2 and 0.8%.

The prevalence of anemia among children was 47% and there were no significant regional differences (Figure 5). Prevalence of anemia in mothers and prevalence of anemia in children were not related (P>0.20). Whereas our sample detected less than 1% severe anemia in children, mild anemia was found in 32% and moderate anemia in 15% of children.

Body mass indexes (BMI) were calculated by dividing weight (kg) by height squared (m^2). The BMI for women did not differ between regions. Average BMI was 24.2 kg/m^2; 6.2% of women were underweight and 36% were overweight. In contrast, Hill and Ismail (1994) found that only 5.7% of the women were obese and 11.8% were moderately or severely malnourished.

Figure 5: Prevalence of different degrees of anemia in rural children and women of Kazakstan.

Growth of children was assessed by calculating height for age z-scores. We found that 12% of the children were stunted (z-score< median-2 s.d.), and 5.2% were severely stunted (z-score< median-3 s.d.).

Current nutritional status of children was determined by calculating weight for height z-scores. Approximately 1.4% of our sample population were found to be wasted and 1% exhibited severe wasting. Three percent of children were moderately underweight.

Weight for age z-scores were calculated to indicate the overall nutritional health of the children. We found 7.6% to be moderately underweight, and 1% to be severely underweight for age relative to the reference population.

Overall, our preliminary results indicate that nutritional health of rural women and children in the Central and Southern regions of Kazakstan compare favorably with previous reports. This was unexpected, and it may be due to differences in the populations sampled or actual changes in the overall population. This question will be addressed by the full analysis of our complete data set.

Livestock and Land

Information on the number of household livestock (camels, cows, horses, sheep, goats,

pigs, rabbits, and poultry) was collected along with information about the fate of the products from these animals (milk, meat/eggs, wool/skin/feathers). Southern and Central households did not differ in total number of livestock ($P>0.20$, $X=8\pm5.4$ animal-unit equivalents per household), but small livestock (sheep, goats, pigs, rabbits and poultry) were more abundant in the Southern region.

Households in both regions reported selling meat, and no differences were detected in the amount of meat from large ruminants sold in each region. However, a larger proportion of Southern households reported selling meat from small livestock ($P<0.05$).

Households were asked about decreases in their livestock from 1990-1996 as well as in the last year. Whereas 57% of Central households reported livestock reductions between 1990 and 1997 due to lack of feed and cash, only 7.4% reported declines in the Southern region. In the last year (97-98), 44.4% of the Central households reported decreases, again because of the need for money and high cost of feed. In contrast with the past 8 years, 59.2% of Southern households reported decreases due to the lack of cash in the past year.

Access to garden, orchard plots, and other agricultural land was examined. Seventeen percent of the households had no land; 44% had only gardens; 15% had a garden, orchard and fields; 7.8% had a garden and an orchard; and 15% had a garden and a field. There were significant differences in access to agricultural land between the two regions ($P<0.001$, Table 1). The Central region was characterized by having access to crop fields or vegetable gardens, whereas the Southern region was characterized by access to orchards or garden plots. Furthermore, all households without any type of land were located in the Central region.

Both regions reported decreases in the amount of vegetables and/or grains grown in the last year. Lack of water and change in climate were the most commonly reported reasons.

Livestock Marketing Survey

(Text in this section was written by C. Kerven and edited for this report by E. Laca)

This study covered a 300 km transect in western Almaty Oblast. The transect incorporates the ecological variation exploited by livestock-keepers moving seasonally with their livestock, and follows a northwest-southeast gradient beginning in the north with sand dune desert south of Lake Balkhash, through semi-desert and steppe, and ending in the south with the high altitude meadows of the Tien Shan (Ala Tau) mountains.

Table 1: Access to agricultural land by households in Central and Southern Kazakstan. - Table entries are percentage of all households in each region. Sample size was 90 and 27 for the Central and Southern regions ($c^2=87$, df=113, $P<0.001$).

Interviews were carried out with livestock producers and farm administrators situated within three major ecological zones; semi-desert, semi-steppe and mountain pastures. The sample included 7 different co-operative farms, from which 24 employed shepherds and 20 private farmers were interviewed. A total of 7 staff, including Directors and technical personnel, of 3 cooperative farms were also interviewed, as well as village administrators and their deputies from 2 village centers of cooperative farms. Interviews were also carried out at 3 livestock or fodder markets in Almaty, and the regional administrative center, with a total of 13 buyers or sellers. Finally, several urban-based key informants were interviewed. A total of 71 individuals were interviewed between 13 July and 4 September.

Interviews included examples of most institutional forms of livestock farms now found:

- production cooperatives (3)
- joint stock cooperative (1)
- Institution farm (1)
- state-registered private farmers (8)
- unregistered private farmers (12)
- employed shepherds of cooperatives, joint-stock and institutional farms (24)

Data from a national sample survey of livestock marketing and unpublished official statistics on livestock numbers within the study area were obtained.

A checklist was used for interviews with producers. Not all information in the checklist could be collected in each interview for the following reasons. Respondents were sometimes unwilling to divulge certain information, for example, on how many animals they owned or sold. A few respondents became impatient with answering the questions, and cut short the interview. On other occasions a respondent would have to leave in order to attend to an immediate task, for example, catching up with sheep grazing on the open range. However, any lack of numerical data is counterbalanced by the insights which some respondents offered, for example, on their strategies for marketing livestock, on how livestock markets are controlled, or reasons why prices varied by season. This information is reflected in the analysis of the numerical data.

For interviews with cooperative farm and village administrators, a more open-ended approach was used. General questions were asked on the production and marketing of livestock by the cooperative farm, as well as specific questions on the quantities, prices and seasons of sales. Some administrators were reluctant to reveal their farm marketing strategies, and information obtained is therefore not complete. Field work involved camping at the grazing areas and small villages where livestock producers were situated during the summer months. In this way, it was possible to observe some of the livestock management and marketing practices, in addition to interviewing people.

Preliminary results of marketing survey

(Text in this section was written by C. Kerven and edited for this report by E. Laca)

In spite of the relatively short time since market liberalization, a small group of commercially-oriented farmers is clearly established. These farmers do not simply sell disposable surpluses but produce to meet specific market demand. Sales are planned, timed to coincide with optimal prices; particular types of animals are selected for the market, and raised in a manner which makes them more marketable. The commercial objective does not prelude dependence on livestock also for meeting family subsistence requirements. Subsistence-oriented producers, by contrast, sell on an ad hoc basis, often under economic pressure. Although production is not geared toward marketing, these producers are forced to sell to maintain an income. The orientation of production depends on the scale of operation. Farmers having more than about 50 sheep can be commercially oriented, but those with very few livestock find this impossible. The largest operations, with hundreds of sheep (or equivalent number of animal units) exhibit characteristics of commercial operations in market economies.

Marketing is also firmly privatized. The state plays very little part in marketing livestock and their products. The state controls and taxes animal movement to market, and is in charge of inspection of animal products for sale. Enforcement is the task of police and veterinary personnel, often involving bribery.

Separate market channels exist for various products - live animals, meat, sheep wool, goat

hair, camel hair, karakul pelts, merino-type pelts, etc. Entrepreneurs usually specialize in handling only one of these products. Small- scale buyers purchase the products from rural producers at the farm, and then sell them at wholesale prices to retailers in towns. These middlemen connect producers with consumers and profit from the differences in price between farm and central markets. In another category, farmer-entrepreneurs specialize in buying and fattening young or thin livestock to resell them for a profit at consumer markets. Their presence indicates that a stratified livestock production system is developing.

Thus, there are clear signals that foundations are laid for an integrated modern commercial meat livestock industry; profitable and segmented along specialized lines. Internal demand for meat remains high in Kazakstan, where meat is valued in the culture. Export channels, however, are limited mainly due to veterinary health problems. Nevertheless, the capacity exists for expansion of the meat sector, both to supply domestic and international markets.

The prognosis for livestock products other than meat is not clear, and the situation for each commodity is different. Demand for wool within Kazakstan is weak, as former state wool-processing and manufacturing industries have collapsed. Most wool is exported to China, but producer prices are low, reflecting the low world price for wool for the past several years. Farmers do not consider income from wool, at US$ 0.60/kg, as a significant contribution to their incomes. As a result, most private farmers are switching from keeping wool breeds such as the dominant Merino-Kazak cross breed in the study area, to purely meat breeds, in particular, the hardy Kazak fat-tailed sheep. Other animal fibers, including goat and camel hair are sold by some producers. A type of angora goat, with a fine, long fiber, is kept by many farmers, some of whom sell the goat fiber to itinerant entrepreneurs or directly at urban markets. Camels are kept by only a few farmers, and the hair is also sold to middlemen, for resale either to a local small factory in Almaty or for export. The price received for camel hair is very low, by world standards, and farmers do not receive significant income from this product. There is a demand for sheep pelts, for making the warm winter coats used by rural people in winter. A factory in Almaty makes these coats, but most pelts are exported to China, as prices across the border are much higher - up to double. Middlemen buy from Kazak producers and sell onto Chinese businessmen either in Almaty or at the border. Some Kazaks also cross into China to sell directly to Chinese factories.

Strong local demand for milk and diary products has led to some small-scale entrepreneurs, usually women, establishing regular deliveries of cows' milk from villages within a radius of Almaty, to the city. Due to the perishable nature of milk, and lack of refrigeration facilities, this marketing tends to be from villages not further than about 4 hours drive from Almaty. Income from sales of milk is particularly important to very poor farmers who may only have one or two milk cows. Further from urban centers, intra-village sales of milk and home-made butter take place, by women. Camel and horse milk is fermented at home for sale, by some farmers, and is highly prized for medicinal properties. However, urban links are poorly-developed for these commodities, such that little reaches the urban markets. Formerly, state farms collected milk and fermented mares' milk, for sale to institutional canteens during the peak production period over summer, but this service no longer functions. Consumer demand for these products is strong, and investment in small-scale dairy marketing would be justified. At the other end of the scale, some European firms have invested in dairies in Kazakstan, producing packaged milk products.

Thus, the greatest proportion of income from the sale of animal products comes from meat, for all producers, regardless of size, species kept, or whether individual or cooperative farms. Animals are sold either alive, for immediate slaughter at the urban markets, or slaughtered, and the meat transported to market. A proportion of animals

marketed are bought by other producers, either to fatten or to add to their inventory. It is more profitable to sell an animal alive for slaughter, as buyers prefer to see the animal and particularly value animals with more fat. However, poorer farmers cannot afford the transport costs of taking animals to market, and therefore slaughter at home and take only the meat to be sold.

Sales of animals for slaughter take place through the year, but more commercially-oriented producers time their sales to periods when market prices are highest. Small-scale producers sell a few animals frequently, sometimes once a month, whereas commercially-oriented farmers only sell once or perhaps twice a year, in large batches. The best prices occur in early spring (February-March), but only for fattened animals. As is typical of less-developed livestock sectors, fewer animals are offered for sale in winter, as the bulk of smaller producers try to retain their animals over winter until they can be fattened on free, natural pastures in the spring. Those animals which are sold by small-scale producers in winter are thin and underweight, and therefore not attractive to consumers. In March there occurs an important national holiday period of the Kazak New Year (*Naarus)* when families try to slaughter animals for feasting. If producers can sell a fat animal at this lean period, they can obtain a premium price. While most producers are aware of the price differentials by season, only larger-scale farmers have the resources to take advantage of these differentials bymarketing fat animals when few are for sale. Larger-scale farmers can obtain the better prices by being able to afford better-quality and quantity of feed over winter. Wether lambs are kept in barns for up to six months before and during winter, and fed on grain and the more nutritious cut grasses. Although most farmers are aware that livestock production depends on good quantity and quality of feed, small-scale farmers have to feed their stock whatever is cheapest, and let the sheep graze in the open as much as possible over winter.

The period when livestock prices are lowest is late summer and autumn (August-October). By then, most animals have reached their best body condition by grazing over the spring and summer. A "buyers' market" prevails, as supply is high and a new winter looms. Flocks and herds are culled to avoid keeping surplus animals during the winter months, when forage is scarce and feed is expensive. Many small-scale and poor farmers try to sell their surplus animals at this time, as they need cash for winter food supplies and necessities for school children. Commercially-oriented farmers, on the contrary, do not sell at this period, but instead buy fodder from the new harvest, and prepare to fatten up their young animals over winter.

Overall there has been a long term trend toward increasing livestock prices, over which typical seasonal trends are superimposed. Prices for livestock and products also vary by distance from the principal markets. The price received by producers is lower if they sell locally rather than in one of the main markets, and is lower the further away from a main market. For example, the price of an adult male sheep in the summer of 1998 was 3000, 5000, and 8000 tenge (Kazak currency) at a small village 300-400 km form Almaty, at Uzan Agach market, and at the Almaty market, respectively.

Gender

Addressing women and children in multiple ways is a central part of our project. Women were involved directly and intensively as executive administrators, senior and junior scientists, staff, students, end users and foci of the project. Four out of five U.S. students directly involved in our project are female. One woman (Karibayeva) represents the Ministry of Ecology of Kazakstan before our group. Six key scientists (Soyunova, Kerven, Shabanova, Karibayeva, Kurochkina, Abuova) working in fields ranging from human nutrition to GIS are female. During the summer of 1998, 270 women and their children

were interviewed, and received a health evaluation and recommendations for the amelioration of nutritional problems. Two women were hired as interpreters and one as liaison staff.

Policy

In preparation to have long-term policy impacts, our team incorporated appointed representatives of the Ministry
of Ecology of Kazakstan (K. Karibayeva), Ministry of Nature Use and Environmental Protection of Turkmenistan (A. Babaev), and the Association of Livestock Producers of Turkmenistan (O. Hodjakov). Appointments by the Ministry of Agriculture and the Agency for Central Planning and Reform of Kazakstan were requested and are pending. The main role of the appointed team members will be to maintain their institutions appraised of our activities, and to provide them with the information generated. Additionally, their participation as team members ensured direct inputs from the institutions into our objectives and plans. The aforementioned linkages are described in detail below.

The Institute of Ecology and Sustainable Development (IESD), under the direction of Dr. Ludmila Shabanova and Dr. Kuralay Karibayeva, is one of the main collaborating institutions and our link with the Ministry of Ecology of Kazakstan. The IESD has been in charge of building the GIS for Kazakstan and has provided general assistance to our project in the region. Ludmila and Kuralay work at the Ministry of Ecology of Kazakstan, and they constitute a strong link between our project and the Ministry. During my trip in March 98 I had a meeting with the deputy Minister of Ecology. During this meeting the deputy Minister expressed his interest in our project being linked to the NEAP-SD, and verbally appointed K. Karibayeva as the official representative of the Ministry in our project. We agreed that a symbolic contribution from our project to the NEAP-SD effort would be in order. The vice Minister delegated the development of this link on K. Karibayeva. We are now working on formalizing this link.

The Institute of Deserts, Flora, and Fauna of Turkmenistan (IDFF), within the Ministry of Nature Use and Environmental Protection, is the main collaboration institution in Turkmenistan. In March 1998, E. Laca and other team members briefed Dr. P. K. Kurbanov. Minister of Nature Use and Environmental Protection of Turkmenistan, on our LDRCT project and requested the nomination of a representative for our team. Minister Kurbanov appointed Dr. Agadjan G. Babaev, director of the IDFF, as representative, and he expressed keen interest in the establishment of a formal link between our project and the Ministry.

A strong linkage with another user institution was established during a meeting with Dr. Deryakuly C. Karadurdiev, Chairman of the "Turkmenmallary" Association of Cattle-Breeding Joint Stock Companies of Turkmenistan. This association functions at a level comparable to a Ministry of Animal Husbandry. Since the abolishment of the Academy of Sciences, the "Turkmenmallary" Association houses the former Institute of Animal Husbandry and Veterinary Science, which is directed by Dr. O. Hodjakov. Chairman Karadurdiev was briefed on our project. He expressed strong support of our objectives, and appointed Dr. Hodjakov as representative of the Association in our team. As described above in the Research section, Dr. Hodjakov has conducted research on agricultural statistics, agricultural policy, and livestock production systems within our LDRCT project. The information and databases that will be created reside in the "Turkmenmallary" Association, and are immediately available to Chairman Karadurdiev.

Dr. Z. Zhambakin, Director General of the National Federation of Private Farmers of

Kazakstan has been a team member since the inception of the LDRCT project. Dr. Zhambakin contributed directly to the objectives and planning for the rural surveys through meetings and review of survey forms. He is among the major players who, in collaboration with VOCA, are submitting proposals to shape the new farm policy (e.g. the new law on cooperatives) in Kazakstan. Thus, Dr. Zhambakin provides another direct link between our group and policy in Central Asia.

Finally, by meeting with and briefing the Minister of Agriculture, and the staff of the Agency for Strategic Planning and Reform (ASPR) of Kazakstan, we established the basis for further involvement of policy makers at the highest level. Dr. Khaslan K. Kusainov, Director of the Department of Socio-Economic Reforms within the ASPR, and his staff attended a detailed presentation of our project by E. Laca, D. Johnson, and T. Gilmanov. He expressed support for our plans, and indicated particular interest in the Basic Resources and CO_2 modules.

Outreach

We targeted and successfully reached multiple level of users, in many cases exceeding our expectations. At the lowest hierarchical level, rural surveys allowed direct involvement of rural families in expressing what their problems and concerns are, as well as in proposing the solutions they feel are necessary and feasible. Women were informed of their and their children's nutritional status as indicated by hemoglobin levels and anthropometry. National research institutes, NGOs and universities participate as mid-level end users and future sources of information for both lower and higher hierarchical levels. Our success in reaching this second target level is documented throughout this report. A large number of institutions and scientists were supported, directly involved in the research, and trained. At the highest hierarchical level of decision-making, we continued and increased collaboration with members of Ministries, farmers associations and NGOs to ensure that information is relevant, and that the project has impacts beyond its term.

Goals, activities and results have been disseminated through popular press articles, presentations at scientific meetings, and publication of technical papers. A large number of people were also reached directly through meetings, workshops and surveys.

The problem of quantifying the magnitude of CO_2 flux and assessing the carbon sequestration potential in principal rangelands of Central Asia were acknowledged to be of prime importance by administrators at a number of key governmental, research and management institutions in Kazakstan, Uzbekistan and Turkmenistan, including ministries of the environment/nature conservation, academies of sciences and leading agricultural, land management, and rangeland research institutes. During visits to the region in spring 1997 and 1998, the institutions interested in receiving the data and modeling results from the CO_2 flux subproject included: Kazakstan (Ministry of Science; Academy of Science; National Academic Center for Agrarian Research; Ministry of Agriculture), Turkmenistan (Academy of Sciences; Regional Center for Prevention of Desertification; Ministry of Natural Resources and Environmental Protection; Research and Production Center of Ecological Monitoring), and Uzbekistan (Ministry of Agriculture, Institute of Karakul Sheep Breeding). The extension approach adopted in the CO_2 flux module will be based upon: (1) informing the target institutions and individuals about the results of the CO_2 flux evaluations at the three monitoring stations; (2) sharing quantitative models to predict CO_2 flux rates as functions of environmental factors and management decisions; and (3) discussing with the target institutions the resultant maps of CO_2 flux rate and estimated carbon sequestration potentials derived from combining flux models with the GIS of basic ecological resources of the Central Asian states.

Developmental Impact

Basic Resources and GIS

Our LDRCT project is already having a significant environmental impact through its link with the Institute of Ecology and Sustainable Development (IESD), which is directed by Drs. Ludmila Shabanova and Kuralay Karibayeva, and is one of our main collaborating institutions. The IESD has been in charge of building the GIS for Kazakstan and has provided general assistance to our project in the region. Drs. Shabanova and Karibayeva also work for the Ministry of Ecology and Bioresources of Kazakstan in the National Environmental Action Plan (NEAP), and they constitute a strong link between our project and the Ministry. Our project contributes significantly to the long-term strategy for Kazakstan (Plan 2030) set forth by the Ministry of Ecology and Bioresources. At least the following priority areas identified by the NEAP are impacted by our project.

Improvement of rational pasture use system. We have performed rural surveys and field measurements to assess the ecological condition of rangelands as affected by livestock and human use. Data will be used to diagnose problems and suggest management techniques to restore degraded lands and conserve those in good condition. Literature reviews and consultation with experts will generate a set of feasible alternative options that will be tested in commercial farms. These activities involved the training of young scientists and building of research capacity, and in the future will include training of land managers, and demonstration of results with on-farm experimentation. Rangelands and abandoned marginal croplands in the steppe and dry steppes of Akmola oblast are included in our studies. Other activities that will be conducted under our USAID-funded project and that relate directly to this aspect of the NEAP are:

1. a. Modeling of pasture production and estimation of grazing capacity.
2. b. Assessment of the role of wells on the degradation and utilization of rangelands.
3. c. Microeconomic evaluation of grazing technologies.
4. d. Analysis of effects of different agricultural policy instruments in the adoption of different technological options.

Inventory of environmentally affected non-fertile lands and their transformation. The IESD has been in charge of preparing a GIS for Kazakstan. We have provided them with advice, funds and equipment (a total of about $30,000) to create the GIS. The GIS has already been very helpful for the presentation and planning of the Long-term Strategy within the NEAP

Improvement of arable land fertility

A focal point of our project is to determine the successional processes that take place in abandoned croplands in the Akmola oblast. A student has been recruited to study cover crops and pasture rotations to restore fertility and conserve land. Basic CO_2 flux information from an almost pristine steppe area was collected for the 1998 growing season and will be used to assess the role of abandoned croplands, cover crops and pasturelands on the absorption of atmospheric carbon dioxide. We hypothesize that restoration of marginal croplands to permanent pasture, and improvement of degrade rangelands can account for significant sequestration of atmospheric carbon.

Rangeland Forage Capacity and CO_2

Obtaining information of the magnitude and distribution of the CO_2 fluxes in the principal rangeland types of Central Asia has direct relevance to understanding the environmental situation in Central Asia and its improvement through scientifically based management decisions. For example, the 30-year long study of carbon balance of the chernozem soils in northern Kazakstan conducted at the Barayev Research Institute of Grain Farming (Kazakstan) indicated a 25 to 30 percent reduction of humus reserves under cultivation. Transformation of at least part of these lands (especially in the region of marginal agriculture in northern and central Kazakstan) into managed pastures constitute a significant reserve of carbon sequestration that could minimize subsequent wind and water erosion. In Uzbekistan, plowing desertified steppes and semidesert rangelands in the foothill zone for wheatproduction is taking place. Thus, information obtained in Kazakstan will be directly relevant to forecasting the situation in these lands of Uzbekistan under alternative management schemes.

Estimation of the potential effect of these processes on the carbon balance of the affected soils in Uzbekistan (where presumably a substantial loss of soil organic matter will take place through accelerated wind and water erosion of those light-textured, loose soils) will help in making wise decisions regarding the management of foothill ecosystems. The desert shrub rangelands of Turkmenistan are being over-exploited by year-round grazing. Data concerning the seasonal dynamics of ecosystem productivity from continuous CO_2 flux measurements will provide critical information necessary to make good decisions concerning sustainable management of forage resources. The RF subproject has established close links with the USDA-ARS Rangeland CO_2 Flux Network, including the sharing of data processing algorithms. Results of the CO_2 flux research on the rangelands of Central Asia will be used to compare and inter-calibrate flux measurements and models in the steppe and semidesert regions of the western U.S. The RF subproject has close cooperation with the International Centre for Agricultural Research in Dry Areas (ICARDA), which contributed expertise, equipment, and resources to the establishment of the CO_2 flux station in Uzbekistan. Plans are being considered to establish additional CO_2 flux monitoring stations at several ICARDA research sites in rangelands of the Middle East and North Africa, which together with the Central Asian sites will form a network of CO_2 flux monitoring sites in arid/semi-arid regions of the African and Asian continents.

Animal Production and Human Nutrition

Based on her survey work, Dr. C. Kerven ("Analysis of livestock marketing by households and cooperatives in western Almaty Oblast, Kazakstan," report in preparation) made the following preliminary recommendations that are of relevance for the development of small-scale livestock farmers and cooperatives.

- Seasonal agricultural credit should be provided to small family groups, for production of winter fodder crops. Credit is needed to buy spare parts, fuel, and seeds.
- Transportation to markets should be facilitated. Cost of transport is a major constraint to small-scale herders in marketing livestock, and it contributes to a steep decline in price from consumer market to farm.
- Local micro-processing of livestock products, including pelts, milk, and meat, should be promoted.
- Specialized wool and pelt production and local processing should be developed. Potentially high-value wool and pelts already exist but currently obtain very low prices. Small-scale producers could be assisted by improvement of breeds, livestock management and processing.
- Development of export markets for specialized accessible to small-scale producers

of high-value products would be necessary.

A Memorandum of Understanding was signed between UC Davis LDRCT project and the Institute of Nutrition of Kazakstan to collaborate in the survey and to express interest in future collaboration to further develop the Kazak food composition database.

The following contacts were made by M. Carpenter on behalf of our LDRCT project.

- USAID, Environmental Desk, K. McNamara. Spoke about project, survey implementation.
- Counterpart. Discussed grants made to small farmer organizations, received a list of farmer non-governmental organizations throughout Kazakstan, consulted with regards to "Farmer to Farmer" training, received help of two instructors for training of survey teams.
- WHO, Eastern Europe and CIS Desk. Discussed nutrition research in Central Asia and where efforts would be most fruitful, discussed cooperation on further development of the Food Composition Database, received informational materials.
- UNICEF, CARK office. Met with director of the anemia prevention project, and former office director about future programs, discussed development of food based projects in addition to already planned supplement and fortification projects, discussed work with the Kazak Nutrition Institute and their current joint projects.
- TACIS, Farm Development Program and AgroInform. Learned about projects in the region, including a radio program on agriculture, small farmer support project, publications, received copies of TACIS reports on the agriculture sector.
- International Red Cross, Almaty Office. Learned about activities in country, their role relative to the national office, and training efforts.
- UNDP Health Office, Almaty. Met to discuss further development of their 1996 nutrition assessment project in Kazakstan, learned that UNDP will be focusing on issues of development policy rather than strict nutrition research.
- ISAR, Central Asia Office. Discussed grants made to small farmer organizations, received a list of farmer non-governmental organizations throughout Kazakstan.
- VOCA, Almaty. Discussed our LDRCT and a BASIS project they are working on. VOCA brings over US specialists to work with local farms or villages on problems of production. They recently changed their focus to food production and processing rather than agricultural production. Consulted on problems and concerns of farmers, as determined by VOCA's work. Received information about farms they provided with volunteers or from whom they received proposals.
- Peace Corps, Kazakstan. Inquired about volunteer placement in villages, and received contact information for volunteers in specific areas.
- HIVOS, Almaty Office. Discussed grants made to small farmer organizations, received a list of farmer non-governmental organizations throughout Kazakstan.
- Soros Foundation Office, Almaty. Consulted director who is an anthropologist expert in the study of nomadic life.
- National Environmental Center. Received oblast level information along with various reports and project proposals issued by the Center (formerly known as the Center for the National Environmental Sustainable Development Program)
- Kazak Red Cross and Red Crescent Office, Almaty. Discussed the vulnerability study implemented by the office in 1997, and their follow-up plans.
- CASDIN, Almaty. Consulted for "Farmer to Farmer" training. CASDIN is one of the forerunning groups trained in participatory rural appraisal work in Central Asia.
- Zhalgas Center, Almaty. Obtained space for meetings and training, use of computers, and an instructor for the "Farmer to Farmer" training.
- Association of Private Farmers, Almaty. Consulted with director about survey and sample development, and site selection, learned about the projects they are working

on, including a micro-credit program.
- Association of Private Farmers, Astana. Discussed farms and problems in the Akmola oblast, their goals, current projects.
- Karaganda Ecological Center, Karaganda (local NGO). Discussed analysis of plants from rangelands located on former nuclear testing sites.

Other Contributions

Team members of our LDRCT project met with Tom Hensleigh, director of Mercy Corps International, and Chuck Moffat of VOCA, both of whom run programs to give small and medium loans to farmers and agricultural enterprises. Both expressed interest in the surveys as a means for their organizations to have current information about the clientele they serve. Because these organizations have to rely in government statistics, they feel that they don't know much about the people they are supposed to be helping. As a result of this meeting, Mercy Corps International and VOCA will receive a complete report on our findings.

Field surveys served effectively as a means to bring heath and nutrition information to the rural population. Nutritionists in the survey team counseled all people interviewed, especially those with low hemoglobin scores. Information was also distributed to emphasize the importance of animal food sources for growing children and women of child bearing age, lag times between meals and tea consumption, and inclusion of leafy green vegetables in the diet. These recommendations were based on materials developed by UNICEF-CARK to fight anemia in Central Asia. Several participants expressed an active interest in their health and queried surveyors about proper nutrition. One of the survey teams included a pediatrician, who was frequently approached for diagnosis and advice. Parents and grandparents alike were very active in taking advantage of this resource, as most villages have at most a medical nurse, clinician, or a health technician. Parents were given recommendations for proper child health care, and were informed of potential growth and health problems. Several parents asked for an initial diagnosis with questions such as "Why is my child sluggish?" "Why isn't my child speaking yet, at age 2.5 years?" "Why isn't my child growing?" "My son is 12 years old and he's shorter than his 8 year old sister; what can I do?" "Is this the proper medicine to give my child?" Participants appreciated the information on their height, weight and hemoglobin level. Heights and weights were measured on all family members.

The survey activity also provided a chance for the distribution of vitamin C supplements and some basic first aid supplies. Candy supplemented with vitamin C was left at each household in an effort to enforce the idea that vitamin C is important with regards to anemia status. Extra medical gloves, band-aids, and alcohol swabs were left with the medical doctor in the last towns surveyed.

A few mayors expressed interest in the initial results of the surveys in their town. They asked if we found that "their" people were healthy, and asked for comments about the village. The mayor of one village asked why there was so much more Artemisia in the rangelands this year, and inquired about the ecology of rangelands. People in another village felt that the survey provided a great service by prompting the mayor to turn the water back on after three days of having no tap water. After the water was turned on, villagers wanted to know if the survey team would ask about electricity.

Leveraged Funds and Linked Projects

Scientists with USDA-ARS at Logan, UT (Drs. Douglas Johnson and Nicanor Saliendra) and Dubois, ID (Drs. Harvey Blackburn and Wolfgang Pitroff) are participating in a joint

sheep/range project in Central Asia with scientists from ICARDA (Drs. Gus Gintzburger and Euan Thompson). The RF subproject has benefited considerably by significant in-kind support from the USDA-ICARDA project. This includes support to purchase and install a Bowen ratio system at the Karnab Site in Uzbekistan, fencing and security guards to secure the CO_2 monitoring site, a vehicle for travel to and from the research site, and a portable shelter at Karnab. Salary support for two Uzbeki field scientists is being provided through the USDA-ICARDA project. In addition, significant travel expenses were paid by the USDA-ICARDA project to select the two other field research sites and identify cooperating scientists in Turkmenistan and Kazakstan as well as to install the Bowen ratio equipment and train cooperating scientists at the three monitoring sites. Support from the USDA-ICARDA project for CRSP-related research in Central Asia is estimated to be about $60,000. In addition, USDA salary support for Saliendra (50% time) and Johnson (10% time) on CRSP-related activities is estimated to be another $34,000. Thus, a total of about $94,000 has been leveraged through interaction with the USDA-ICARDA project.

M. Carpenter obtained the following funding to conduct the human nutrition research:$3000, Jastro Shields Research Grant, UC Davis; $500, Hemocue, Co. (donation of equipment); $1000, Institute of Nutrition, Kazakstan (donation of equipment).

This project is closely linked to the activities of ICARDA in Central Asia through common team members (E. Thomson, A. Aw-Hassan, M. Suleimenov). ICARDA provided approximately $4500 for E. Laca to travel to Aleppo to plan joint research and extension activities in Central Asia. In addition, ICARDA provided $24,000 of in-kind matching funds. A subcontract was signed with ICARDA to regulate the collaboration during 97-98 and the bases for further collaboration were discussed. E. Laca, T. Nordblom, and M. Demment were involved in the original development of the ideas for a proposal from ICARDA to IFAD for a linked project. Dr. Nordblom developed an initial concept paper that was later modified and submitted by ICARDA to IFAD. Although no formal agreements have been made yet, there is an understanding that if funded, the IFAD project will support the extension aspects of our project. In specific, ICARDA scientists expressed interest in supporting our on-farm research and demonstration activities.

Our LDRCT project is linked to the project entitled "Impacts of privatization on range and livestock management in semi-arid Central Asia," funded by Department for International Development, British Government and managed by the Overseas Development Institute, London. The PI of this project is Dr. Carol Kerven, who is also a member of our team and who conducted field work with funding from our GL- CRSP project. Dr. Kerven's project is in collaboration with:, Macaulay Land Use Research, Kazak Pasture and Fodder Institute, and Institute of Animal Husbandry and Pastures, Turkmenistan. Total cost of her project is $384,000 over 2 years from 1998-99.

Through common members (L. Shabanova and K. Karibayeva), our project is formally linked to the implementation of the National Environmental Action Plan (NEAP)led by the Ministry of Ecology of Kazakstan. The deputy Minister expressed his interest in our project being linked to the National Environmental Action Plan (NEAP), and verbally appointed K.Karibayeva as the official representative of the Ministry in our project. We agreed that a symbolic contribution from our project to the NEAP effort would be in order. The vice Minister delegated the development of this link on Dr. Karibayeva. The GIS that was built with USAID SR-CRSP by the Institute of Ecology and Sustainable Development funding, an NGO headed by Dr. Shabanova, has already been used for the purposes of the NEAP. The link between LDRCT and NEAP is described in greater detail in the section on Developmental Impacts above.

Training

Degree Training

Abigail Breuer, MS, 1999, Agronomy and Range Science, Grazing and conservation of rangeland resources, University of California, Davis.

Mary Carpenter, MS, 1999, International Agricultural Development, Linking human nutrition to livestock systems, University of California, Davis.

Karen Olmstead, MS, 1999, Biological and Agricultural Engineering, Remotely sensed trends of rangeland condition in Kazakstan, University of California, Davis.

Adam Wolf, MS, 2001, International Agricultural Development, Cover crops to restore soil carbon, University of California, Davis.

Kevin Gonzago, University of California, Davis.

Short-term Training

Workshop: Participatory rural survey methods. NACAR, Almaty, Kazakstan, 23-31 July 1998. Sixteen scientists and students from Kazakstan and UC Davis participated in the workshop and received instruction from ICARDA and UC Davis scientists.

Workshop: Human nutrition surveys. NACAR, Almaty, Kazakstan, 23-31 July 1998. Six staff members of the Institute of Nutrition of Kazakstan were trained in interviewing techniques, and use of hemoglobin equipment, mother-child UNICEF scales, and height boards.

Farmer to Farmer communication: NACAR, Almaty, Kazakstan, 22 July 1998. Sixteen scientists from various institutes of Kazakstan participated in the training organized by UC Davis, ICARDA and Zhulgas Center.

Range condition assessment: Institute of Pasture and Fodder of Kazakstan, Almaty, 31 July 1998. Three members of the survey teams learned how to conduct vegetation measurements from I. Alimaiev.

Workshop: Introduction to Global Positioning Systems. NACAR, Almaty, Kazakstan, 31July 1998. Sixteen scientists and students from Kazakstan and UC Davis participated in the workshop and received instruction from E. A. Laca.

Special training: In April-May 1997, Dr. Nasyrov from Uzbekistan was brought to the U.S. and trained to install, operate, maintain, and trouble-shoot the Bowen ratio equipment at the USDA-ARS Forage and Range Research Laboratory in Logan, Utah and the U.S. Sheep Experiment Station in Dubois, Idaho. During 7 May to 6 June 1998, Drs. Saliendra and Nasyrov traveled to Kazakstan and Turkmenistan and provided similar on-site training to collaborating scientists (Drs. Dourikov, Gedemov, and Akshalov) in the operation of Bowen ratio systems and subsequent data processing.

Collaborating Personnel

United States

Douglas A. Johnson, ARS-USDA, Utah State University.

Tagir Gilmanov, South Dakota State University.

Nicanor Z. Saliendra, Research Assistant ARS-USDA, Utah State University.

Emilio A. Laca, Assistant Professor University of California, Davis.

Richard Plant, Professor, University of California, Davis.

Lovell S. Jarvis, Professor, University of California, Davis.

Richard Howitt, Professor, University of California, Davis.

Abigail Breuer, Graduate Student, University of California, Davis.

Mary Carpenter, Graduate Student, University of California, Davis.

Louis E. Grivetti, Professor, University of California, Davis.

Kazakstan

Ludmila Shabanova, Institute of Ecology and Sustainable Development.

Karibayeva, Institute of Ecology and Sustainable Development.

Sharmanov, National Institute of Nutrition.

Iliya Alimaiev, Institute of Forage and Rangelands.

Kasim A. Asanov, Professor, Institute of Feed and Pasture.

Azimkhan A. Satybaldin, Professor, Ministry of Science-Academy of Science RK (MS ASRK).

Kanat Akshalov, Barayev Research Institute of Grain Farming.

Akhylbek Kurishbayev, Director of Barayev Kazakh Research Institute of Grain Farming; Ministry of Science-Academy of Sciences.

Zhapar Zhambakin, Director General, National Federation of private Farmers of Kazakstan.

Turkmenistan

Moukhamet Dourikov, National Institute of Deserts, Flora, and Fauna.

Tachdurdy Gedemov, Director of "Biotechnology", Scientific Technological Centre, Academy of Sciences of Turkmenistan.

Agadjan G. Babaev, Director Desert Research Institute, Turkmenistan.

Ovlyakuli Hodjakov, Institute of Animal Breeding and Veterinary.

Ogultach Soyunova, Inst. For Animal Management.

Uzbekistan

Mukhtar Nasyrov, Professor, Samarkand State University.

Uktam Aripov, Director General, Res. & Ind. Assoc. for Karakul Sheep Husbandry.

Rasulmat Khusanov, Uzbek Research Institute of Market Reforms Ministry of Agriculture.

ICARDA

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[1] *(Note that the exact amount of credit, if any, due to our LDRCT project for the publications by C. Kerven is not yet determined. We list them here tentatively, with the kind approval of C. Kerven).*

[2] *(Note that the exact amount of credit, if any, due to our LDRCT project for the abstracts and presentations by C. Kerven is not yet determined. We list them here tentatively, with the kind approval of C. Kerven).*

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