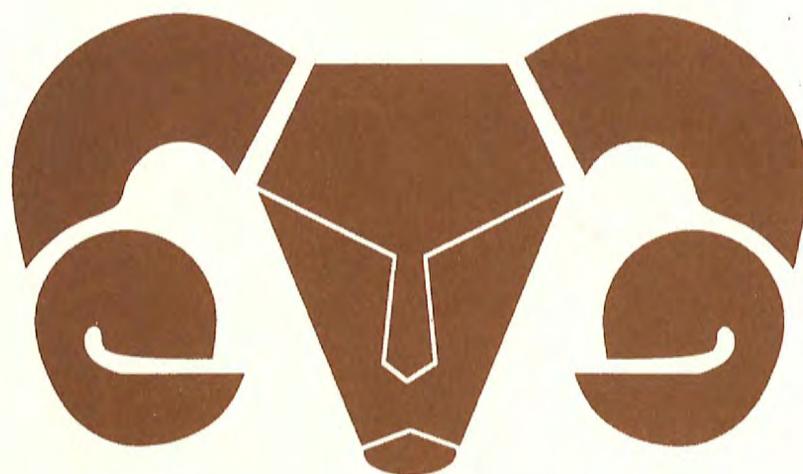


GLOBAL LIVESTOCK COLLABORATIVE
RESEARCH SUPPORT PROGRAM

YEAR
2000

INTERNATIONAL CONFERENCE



MARCH 15 - 18
AUTLAN DE NAVARRO, JALISCO
MEXICO



UNIVERSIDAD DE GUADALAJARA
Centro Universitario Costa Sur
Instituto Manantlán de Ecología y
Conservación de la Biodiversidad

GL-CRSP MANAGEMENT ENTITY
University of California, Davis
University of California, Los Angeles
Colorado State University
Texas A&M University System
University of Wisconsin - Madison
Utah State University

GLOBAL LIVESTOCK CRSP



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Designed & Edited by Susan L. Johnson

**BIENVENIDOS DE UNIVERSIDAD DE GUADALAJARA
CENTRO UNIVERSITARIO DE LA COSTA SUR**

El año 2000 es todo un reto para la humanidad, es el parteaguas en donde la humanidad debe mostrar toda su capacidad creativa para sobrevivir en este nuevo milenio. Nuevos y viejos retos son los que tenemos que enfrentar de una manera inteligente y con una filosofía de amistad, dignidad y respeto con nuestros semejantes. The GL-CRSP es un ejemplo de esta capacidad creativa del ser humano para poder abordar de manera interinstitucional, interdisciplinaria e internacionalmente los problemas que plantea la sustentabilidad.

La humanidad debe aprovechar sus virtudes para lograr la armonía con la naturaleza. Los problemas alimentarios, sociales y ambientales del planeta, no serán resueltos sin voluntad política, un enfoque de sustentabilidad y un compromiso intergeneracional.

Muchos individuos, organismos oficiales y asociaciones civiles, están comprometidos en la consecución de un desarrollo sustentable. Esta reunión internacional de GL-CRSP, será de gran importancia para nuestra casa de estudios y para la Costa Sur de Jalisco. Tendremos la oportunidad de conocer experiencias útiles y exitosas que se han estado desarrollando en otros continentes y tendremos el orgullo de recibirlos aquí en su casa, México.

Es sabido que a los mexicanos nos caracteriza un alto sentido de hospitalidad, así como la diversidad de culturas y recursos naturales. Los pobladores de Autlán de Navarro no somos menos en ello. Nos sentimos orgullosos de que este evento se lleve a cabo aquí en México, y les damos nuestra más cordial bienvenida a esta tierra de esperanza.

Mtro. Salvador Acosta Romero
Rector del Centro Universitario de la Costa Sur
Universidad de Guadalajara

(English translation next page)

WELCOME FROM UNIVERSIDAD DE GUADALAJARA
CENTRO UNIVERSITARIO DE LA COSTA SUR

The year 2000 is a challenge for humankind, it is the watershed where humans will have to show all their creativity to survive in this new millennium. New and old challenges will have to be faced in an intelligent manner and with a philosophy of friendship, dignity and respect to ourselves and our fellow men and women. The GL-CRSP is an example of this creative capacity in which humans are able to approach problems in an interinstitutional, interdisciplinary, and international manner and thereby establish sustainability.

Humanity should take advantage of its virtues to achieve harmony with nature. The social, alimentary and environmental problems of the planet will not be solved without political will, an intergenerational commitment and putting sustainability into focus.

Many individuals, government and nongovernment organizations have committed themselves to the attainment of sustainable development. This international CRSP meeting is of great relevance to our University and to the Costa Sur region. We will have the chance of knowing from first-hand sources useful and successful opportunities that are being developed in other continents, and we are extremely proud to welcome you in this, your home, Mexico.

It is known that we Mexicans are characterized by our hospitality, and our country for its cultural and natural diversity. The people of Autlan are not less in hospitality. We are proud that such an important event is being held here in Mexico. We again cordially welcome you to this land of hope.

Mtro. Salvador Acosta Romero
Rector del Centro Universitario de la Costa Sur
Universidad de Guadalajara

Translation by Carlos Palomera

WELCOME FROM GLOBAL LIVESTOCK CRSP

I welcome you all to the 2000 Global Livestock CRSP International Conference. We are delighted to hold our conference in a country in which we are active and with partner institutions with which we have ties, the Universidad de Guadalajara Centro Universitario de la Costa Sur and the Manantlan Institute of Ecology and Biodiversity Conservation. This year marks the third year of full activity for our seven projects and the second year of our 5-year grant with USAID. I believe you will see that we have made considerable progress since our reengineering efforts in 1996-7 and that that initial redesign of the GL-CRSP has improved our capacity to contribute to the development process.

In an age of rapidly advancing technologies the public sector has a major role to play in development. Advances in biotechnology and communication have been achieved through a mingling of private and public efforts but the marketing has been controlled by the private sector. The markets that are most profitable attract the most attention. Their problems are targeted and the private sector invests capital to create products that solve the problems of profitable markets. Without the wealth to purchase the products, developing countries will be slow to attract the private sector to their problems. The issues range from tropical diseases, like malaria, to tropical crops, like cassava.

Can the public sector play a role to assist in the application of new technologies in developing countries? I believe that donors such as USAID and universities can be partners that insure that developing countries have the opportunity to participate fully in the advantages of this technological revolution. Donors can provide the resources to insure that citizens of developing countries have the capabilities to participate in and evaluate new technologies, have the capacity to be entrepreneurial in their regions and can make policy consistent with the rapid but considered advancement of these technologies. They can do this through the investment in education and research.

Donors can work with the private sector in developed countries to provide incentives for private sector investment in developing countries by directly rewarding the development of products that address issues of primarily tropical not temperate environments. In the long run this effort will require that emerging technologies be adapted to a whole new set of systems with their unique problems. This process will require considerable human capital

and new knowledge; two things that the public sector universities have a comparative advantage in providing.

In this age of logical frameworks and impact assessment many of the most important components of international development have suffered, not because we think they are unimportant, but because these planning processes have great difficulty measuring the impact of long term processes. Higher education and research are examples. They do not fit neatly into impact statements nor is it easy or cheap or timely to determine their impact. Yet we all know that building human capital through education and establishing a foundation of knowledge are critical ingredients to development.

In a world of ever accelerating change, we need to understand what are the dynamics of change and we need well-trained people to create solutions to those dynamics. Education, research and knowledge are fundamental to promoting economic growth, food security from which flow lower population growth rates, more representative governments, greater concern for environmental issues and a greater role for women in society.

I believe no better mechanism exists to address these issues than ones that link research, education and development solutions. The CRSPs represent one of the very best of USAID's efforts in this area. These programs use broad-based inputs to identify critical problems, establish research and development projects to address and solve the problems, and within this problem-solving context, educate host country and US students to address the problems of developing countries. The CRSP mechanism utilizes the comparative advantage of US universities to bring modern technologies to bear on the problems of the developing countries. I hope that in the future this productive relationship in the public sector can be used to assist the developing world in its quest for technology and to balance the amazing advances of the private sector that are directed primarily at the developed countries.

Dr. Montague W. Demment
Program Director
Global Livestock CRSP

THE GLOBAL LIVESTOCK CRSP

(formerly the Small Ruminant CRSP)

Established in 1978 as the Small Ruminant CRSP, the Global Livestock CRSP has expanded its research to address important new topics in the international livestock development sector. Projects focus on human nutrition, economic growth, environment and policy linked by a global theme of agriculture at risk in a changing environment. The program involves 7 broad-based interdisciplinary projects involving 13 US universities, 3 international agricultural research centers and 69 foreign institutions. The program is active in three regions of the world: East Africa, Central Asia and Latin America.

The GL-CRSP has chosen to work in ecosystems and regions where human populations and natural resources are most vulnerable and in most cases where biodiversity is at risk. The research proposes to develop the capacity to predict risk so it can be better managed, improve the tools to cope with risk and contribute to mediation of risk. In a world that is changing economically, socially and environmentally at a rapid rate, dealing with risk is critical for the welfare of people living in conditions of marginal food and economic security.

HISTORY

The Global Livestock CRSP, formerly known as the Small Ruminant CRSP, is one of eight CRSP programs developed under Title XII legislation. The CRSP model, pioneered by the SR-CRSP, was built on the structural strengths of US land-grant universities. Four characteristics ensure the effectiveness of this model: 1) Collaboration with US land-grant universities; 2) International training; 3) Long-term scientific relationships; 4) Program cost-effectiveness.

REENGINEERED

Over the past two years, the CRSP undertook a major reengineering of the program that revolved around priority setting in 20 regional conferences involving 35 countries. Assessment teams, selected in an initial competition, developed projects that addressed the top priorities within the regions. The teams submitted final proposals for a competition to be included in a proposal to USAID. The seven final projects are headed by University of California-Davis, University of California-Los Angeles, University of Wisconsin-Madison (2), Texas A&M University System, Utah State University, and Colorado State University. The process was designed to be problem driven and produced results oriented projects.

RESOURCES

Funds for the GL-CRSP are granted for a five year period by the United States Agency for International Development. A minimum cost-sharing contribution of 25 percent from participating US institutions is required. The projects also receive substantial contributions from host country collaborators and leveraged funds.

STRUCTURE

The Global Livestock CRSP is administered as a grant to the University of California, Davis, which, as the **Management Entity**, administers subgrants to participating US institutions and maintains fiscal responsibility.

The GL-CRSP **Program Director** is responsible for program development, coordinating activities of the projects across and within regions, and oversees the daily operations of the GL-CRSP.

The **Program Administrative Council** provides input on the overall program goals, recommends strategies for programmatic development and advises and concurs on the program budget.

The **Technical Committee** provides intellectual exchange and input on programmatic planning for the CRSP to the Program Director and the Program Administrative Council.

The **External Evaluation Panel** provides objective evaluations of the CRSP programmatic process.

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GLOBAL LIVESTOCK CRSP PROJECTS

LATIN AMERICA

Project Title: Livestock-Natural Resource Interfaces at the Internal Frontier.

Team Members Attending: Timothy Moermond, University of Wisconsin - Madison; Sara Baez, Terranueva, Ecuador; Jorge Ruiz, ZONISIG, Bolivia; Gonzalo Piños, CDC, Ecuador; Carlos Vacaflares, PROMETA, Bolivia; and from Instituto Manantlán de Ecología y Conservación de la Biodiversidad (IMBECIO), Centro Universitario de la Costa Sur, Universidad de Guadalajara (CUCSUR), Mexico: Lázaro Sanchez, Maria del Rosario Pineda López, Luis Manuel Martínez, Peter Gerritson, Luis Ignacio Iniguez, Ramon Cuevas, Oscar Cardenas, Mario Carranza, Sarahy Contreras, Arturo Carranza, Salvador García, Enrique Jardel, Arturo Moreno, Guadalupe Hernandez Vargas, Fernando Aragon Cruz, Sagrario Hernandez, Ruben D. Guevara, Juan Pablo Esparza, and Rafael Perez Rangel.

CENTRAL ASIA

Project Title: Impacts of Economic Reform on the Livestock Sector in Central Asia.

Team Members Attending: Kenneth Shapiro, University of Wisconsin - Madison; William Dobson, University of Wisconsin - Madison; David Thomas, University of Wisconsin - Madison; Nurlan Malmakov, Russian Institute of Sheep Breeding, Kazakhstan; Meruert Abuseitova, Kazakh Institute of Oriental Studies; Liba Brent, University of Wisconsin-Madison.

Project Title: Integrated Tools for Livestock Development and Rangeland Conservation in Central Asia.

Team Members Attending: Emilio Laca, University of California, Davis; Bakhtiyor Mardonov, Samarkand University; Valerii Nikolaev, National Institute of Deserts, Flora and Fauna, Turkmenistan; Alexandr Nikolayenko, Institute of Ecology and Sustainable Development, Kazakhstan; Richard Plant, University of California, Davis; Mary Carpenter, University of California, Davis; Adam Wolf, University of California, Davis; Mimako Kobayashi, University of California, Davis.

GL-CRSP PROJECTS (CONTINUED)

EAST AFRICA

Project Title: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity in East Africa.

Team Members Attending: Micheal Coughenour, Colorado State University; Kathy Galvin, Colorado State University; Randall Boone, Colorado State University; E.G. Mtalo, University of Dar Es Salaam, Tanzania; Ololtisatti Ole Kamuaro, Ministry of Environment, Kenya; Stacy Lynn, Natural Resource Ecology Laboratory; Mohamed Maskini, Sokoine University of Agriculture, Tanzania; Fred Atieno, University of Nairobi/ILRI, Kenya.

Project Title: Early Warning System for Monitoring Nutrition and Livestock Health for Food Security of Humans in East Africa.

Team Members Attending: Paul Dyke, Blackland Research Center, Texas A&M University System; Abdi Jama, Texas A&M University; John Corbett, Blackland Research Center, Texas A&M University System; Jean Ndikumana, ILRI; Zinash Sileshi, Ethiopian Agricultural Research Organization; Jerry Stuth, Texas A&M University.

Project Title: Improving Pastoral Risk Management on East African Rangelands.

Team Members Attending: Layne Coppock, Utah State University; Abdillahi Aboud, Egerton University, Kenya; Solomon Desta, Utah State University.

Project Title: Role of Animal Source Foods to Improve Diet Quality and Growth and Cognitive Development in East African Children

Team Members Attending: Charlotte Neumann, University of California, Los Angeles; Nimrod Bwibo, University of Nairobi, Kenya; Edith Mukudi, GL-CRSP Child Nutrition Project; Marian Sigman, University of California, Los Angeles; Constance Gewa, University of Nairobi, Kenya; Jonathan Siekmann, University of California, Davis.

**LIVESTOCK-NATURAL RESOURCE INTERFACES AT THE INTERNAL FRONTIER
IN LATIN AMERICA**

**SPANISH TITLE: "PLANIFICACION LOCAL AGROPECUARIA
Y DE LA NATURALEZA"(PLAN)**

This project is working with rural farming communities in forested mountainous areas of Latin America to improve the quality of life in those communities and to improve the conservation of the natural forests and watersheds of those areas. Our strategy is to promote land use and livestock management that is sustainable at the family level and the community level and sustainable for the environment at the level of the watershed and the region. Livestock are a significant part of the problems of these agro-ecosystems as well as part of the potential solutions. To understand how to reduce the impact of livestock on the environment and how livestock might contribute to a better life for these rural people, we must understand the bio-physical and socio-cultural-economic context of these systems.

The project work is organized around four principal goals: 1) Identify the potentials and limitations within the community for sustainable management of natural resources and livestock, and improvement of quality of life. 2) Generate local participation in planning, implementing, and monitoring current and alternative practices. 3) Evaluate current practices of livestock and natural resource management and develop alternatives. 4) Establish long-term, on-going, local community planning for natural resource and livestock management.

The methodological spirit for program design and implementation is both interdisciplinary and participatory. Knowledge, expertise, and process are to be drawn from different biological and social science perspectives, from universities and NGOs, and from the local communities. The project is focused toward communities and the process explicitly involves and incorporates the people of the communities. Since this program seeks to work with those groups that are most in need, however, our principal beneficiary groups will be small producers, resource-poor families, women, and ethnic minorities.

Within the context at a local community, the realities of local residents must be understood and their active participation engaged in the joint search for possible alternatives.

This joint search for viable and sustainable economic alternatives has pointed towards three main strategies: 1) diversification of economic activities and production systems, 2) increase in equity among the actors in the communities and within families (e.g., increase in women's access to resources and roles in decision-making), and 3) improved community organization and decision-making abilities.

Experiments with alternatives include farm management plans, pasture improvement, reduced chemical use, agro-forestry, and communal vegetable gardens and tree nurseries. These small actions are selected to maximize family resources, diversify the sources of family income, and reduce the environmental impacts of current practices. Our studies of the natural ecosystems in which these families are living will help to design ways to integrate their activities into these systems so as to maintain the natural services of the watersheds and to conserve the rich natural biological diversity that constitute resources for them and the world as a whole.

We are working with community and family groups and leaders to foster and support community organization. Community planning, assisted by the Project, could transform a diverse array of small activities into a sustainable whole.

IMPROVING PASTORAL RISK MANAGEMENT ON EAST AFRICAN RANGELANDS

Pastoral and agropastoral societies in East Africa are caught in a downward spiral of increasing poverty, chronic risk of livestock loss and famine, physical insecurity, and environmental degradation. Delivery of public services in these areas is commonly in decline. Billions of USD have been spent in recent decades providing famine relief, increasingly on an annual basis. The causes of such problems are multi-faceted and ultimately rooted in the pressure created when human populations grow on a static—or shrinking—base of natural resources. We believe that attention to improving pastoral risk management could help alleviate such problems. Risk management is a process of taking various actions to reduce the chance of losing assets, income, or other aspects of well-being. The four elements of risk management are: (1) asset diversification; (2) income diversification; (3) increased access to information; and (4) increased access to external resources. Research will focus on identifying spatial and temporal variation in the need for various risk management interventions among pastoral and agropastoral people in northern Kenya and southern Ethiopia. Research, and feedback from outreach, will help identify those aspects of risk management that are most important and realistic to improve. We expect that opportunities to improve risk management will come from integrated interventions involving education, rural finance, marketing, animal health, conflict mitigation, telecommunications, and rehabilitation of tenure regimes for natural resources. In general, results from research and outreach in Year 2 have confirmed that our original problem model provides a useful framework and approach.

This was the second year of work for this project. We believe it was a successful year. We began with a total of 13 broad objectives for research, outreach, training, and administration and were able to meet all of these. Year 2 was best characterized by five broad achievements: (1) Successfully hiring two new post-doctoral research specialists in pastoral economics and social conflict, who have spearheaded a rapid transition from broad, regional reconnaissance methods in field research during year 1 to a more local, detailed survey approach regarding risks faced by pastoralists and agro-pastoralists in eight stratified locations; (2) successfully holding our first biennial research and outreach workshop for Kenya and Ethiopia in Addis

Ababa, attended by over 80 participants from three-dozen organizations—a major purpose of this meeting was to allow partners to debate and influence project direction; (3) submission of a USD \$388,000 outreach proposal to the Greater horn of Africa Initiative (GHAI), designed to complement core research activities on the GL-CRSP and the concomitant hiring of an outreach coordinator on other outreach funds secured from the USAID Mission in Ethiopia; (4) successful completion of research projects for three graduate students, with another nine students moving steadily through their programs, both in East Africa and the USA; and (5) production of 24 publications including peer-reviewed manuscripts, popular articles, and a thesis and dissertation. These cover a wide range of topics from livestock marketing to risk management, food security, social conflict, and diversification of pastoral economies.

We have remained true to our original problem model. Work plans and outputs in year 2 are almost exactly on track with what we outlined in the original project proposal. In terms of creating a significant outreach capability, it could even be said that we are further ahead of where we thought we would be at this time. Team members have been very productive and creative with resources provided through the GL-CRSP. Overall, we see our progress as very positive given the obstacles imposed by the numerous challenges of working in East Africa today. In short, we believe our progress is related to one basic reason: we are dealing with the “right” issues.

INTEGRATED MODELING AND ASSESSMENT FOR BALANCING FOOD SECURITY, CONSERVATION AND ECOSYSTEM INTEGRITY IN EAST AFRICA

We are developing an integrated modeling and assessment system (IMAS) that integrates computer modeling, geographic information systems, remote sensing, and field studies to provide the information and understanding necessary to conserve biodiversity, wildlife, and ecosystem integrity while increasing pastoral food security. The IMAS quantifies the impacts of land tenure, enterprise scale, and conservation policy on four objective functions: livestock production, pastoral welfare, wildlife, and ecosystem integrity. The system will enable alternative policy and management strategies to be objectively explored, debated, implemented, and reassessed.

The IMAS includes an ecosystem model that spatially represents changes in plant and animal distributions and abundances over time, and the causal factors underlying livestock-wildlife interactions, in terms of plant growth and its responses to climate and grazing. Another model that describes cash-flow and dietary energy intake in pastoral households is being developed and linked to the ecosystem model to investigate scenarios and the impacts of economic and environmental changes, and to assess both ecological and socioeconomic impacts of interventions, particularly as these relate to household food security. An animal disease model is being developed to assess the risks of transmission between livestock and wildlife.

An application of the IMAS to the Ngorongoro Conservation Area, Tanzania was completed. Model experiments represented natural events or scenarios land managers might contemplate for NCA, and were selected in part to demonstrate the flexibility of IMAS methods. Questions addressed the effects of: 1) drought, 2) elevated livestock numbers, 3) improved veterinary care, 4) increased access to grazing lands, 5) changes in water supplies, and 6) growth in human populations and agriculture. The results of these analyses were demonstrated to project scientists, and modifications made where necessary.

Preliminary analyses suggest that the Maasai of the NCA are affected by wildlife conservation policies. However other factors such as landscape variation, distance to

markets, and livestock disease incidence, etc. may also contribute to this human welfare variation. Wildlife is viewed as a potential source of disease to livestock. Although disease incidence varies with ecological setting, virtually all livestock are at risk from all wildlife diseases present in the NCA because of animal movements.

We are now conducting field studies of ecology, land use change, socioeconomic, and livestock-wildlife interactions in Kajiado District, Kenya. One study showed little evidence of severe competition for available resources between livestock and crops - if anything, there appears to be some degree of complementarity. Both crop and livestock enterprises appear to give relatively high rates of return to capital, and most pastoralists and agro-pastoralists are able to derive their livelihood from the two enterprises. Another study documented land use trends such as: 1) sedentarization and government policies which favor a sedentary lifestyle; 2) conversion of dry season grazing areas to cultivation; 3) Privatization of land; and 4) displacement of pastoralists due to civil strife, drought, and cattle rustling.

Field and modeling studies of rangeland condition, livestock nutrition, and pastoral land use are thus providing the necessary information to assess disease, competition, and complementarity between pastoralists and wildlife for forage, water, and other resources. This information will be useful for developing more environmentally sustainable livestock systems in the wildlife rich areas of East Africa.

EARLY WARNING SYSTEM FOR MONITORING LIVESTOCK NUTRITION AND HEALTH FOR FOOD SECURITY OF HUMANS IN EAST AFRICA

The Livestock Early Warning System (LEWS), currently under development, in East Africa involves linkage of several new technologies capable of predicting the current nutritional status of free-ranging animals and the impact of weather on forage supply and crop production among a carefully selected set of households reflecting a variety of effective environments across diverse landscapes of East Africa. These include; Almanac Characterization Tool (ACT) , Near Infrared Spectroscopy (NIRS) fecal profiling technology and advanced biophysical grazingland and crop models.

The Almanac Characterization Tool (ACT) was used initially to stratify large regions into units of similar environments called “effective environments”. The regional extent of the environments occupied by target human population, in this case the pastoral regions of East Africa, was then defined based on known attributes of environments. The ACT system provides a gridded (1 km x 1 km, 4 km x 4 km) geo-referenced database of a wide array of climatic attributes, soil types, human populations, road networks, livestock density, etc. Using principle component and cluster analysis, pastoral landscapes were classified into units which meet the specified constants or attributes selected to define the geographical extent and subdivision in the region. Sampling within the clusters assures that time and funds are targeted for maximum impact and representation of variations across the region.

The focus is on accessible pastoral households, which share common climatic, edaphic and production system attributes distributed throughout a region. Access is critical and hence roads were overlaid with the livestock population density data to devise sampling routes which best represent variation in landscapes and human conditions. To ensure what routes could be taken to best sample representative or modal units. For each sampling point, the landscapes are classified into virtual landscapes or typical plant community/crop combinations characteristic of the region. The proportion of plant community/crop and the modal composition of plant species growing in each ecological unit are defined.

Once a sampling point has been defined (geo-referenced) and virtual landscape characterized for that area, herd populations are estimated based on the sample of the household herd and known livestock population densities in the grazing radius of the household. This information is augmented through interviews with local extension agents

and NGO working in the area. These interviews set the demand from the livestock within the effective grazing zone of a sampling point. Also, the type of crop and the date planting for these areas are determined in the same manner.

Critical to the process is matching weather information with each of the selected sampling sites (households). A WMO station or other reporting station is assigned to each of the effective environments and sampling locations. If a WMO station is not available, there is a recording and reporting mechanism established in a central location to acquire rainfall information and extrapolate temperature and radiation data from other reporting stations. The logistics of locating the most appropriate site within a monitoring zone for a rain gauge/max-min thermometer and assuring a rapid reporting presents a major challenge to the program. To overcome this problem, rainfall estimates are derived from predictions based on cold cloud cover generated by NOAA and distributed by USAID-FEWS and FAO-GIEWS.

A network of scientists and organization from National Agricultural Stations and Universities across the East African region was formed with a common purpose and protocol to establish a livestock early warning system that is regionally cohesive. Key policy people and organizations were also involved to make the system function. Results from four validation sites in the region were used to validate the biophysical models used in LEWS. This was followed by training of key zone coordinators in the use of biophysical models and spatial tools. The main purpose of the training was to build a network of local scientists possessing the necessary skills needed to ensure timely monitoring and effective analysis of emerging crisis in pastoral areas. The goal is to decentralize analysis to the zone level.

Each of the NAR/University in-country teams established a sampling zone, based out of their respective home units. Locations of households and weather stations was based on careful analysis of climatic clusters, accessibility by road and institutional infrastructure to maintain the weather stations.

Experience gained during the coping mechanism survey was valuable in tracking the amount of time it takes to execute the monitoring routes terms of travel distances, access to the household and degree of cooperation by the family. From this analysis the maximum number of households that can be reasonably sampled in four days from each base of operation was set within each defined zone in each country. Once the households were identified and baseline survey conducted, a 3 month test period was initiated from June through August, 1999 to emerge logistical and analytical problems that have to be solved before initiating a limited scale system in year 3.

Finally, a systematic sampling route is being established that will be run every 30 days for a given zone according to the infrastructure available from governmental (i.e. NARs, Extension, schools), NGO and PVO entities. At each sampling date, a fecal sample is collected from a composite of at least 3 animals for each of the livestock species (cattle, sheep, goats). The number of deaths, sales, purchases, gifts and loans of livestock will be acquired from each individual to get some estimate of population changes (demand function). Enumerators, then, forward the fecal samples to a central processing facility for drying and shipment to a regional NIRS fecal profiling lab to predict diet quality (CP and DOM). Currently, this is being done at Debre Zeit, Addis Ababa, Ethiopia but eventually labs will be established in each of the remaining host countries (Naivasha, Kenya; Kampala, Uganda, and Dar es Salaam, Tanzania). The resulting predictions of dietary crude protein and digestible organic matter are entered into a nutritional balance analysis model (NUTBAL-PRO) set up for each monitoring household. Changes in body weight and condition are predicted in 30-day increments and projected over a 90-day projection period. An estimate of loss in body condition, by animal breedtype and class, allows assessment of emerging trends towards malnutrition, disease, parasites and drought loss.

Predicted intake demand of the herds is passed to a grazingland production model (PHYGROW) where spatially referenced 14-day increment of weather data is fed to the model to simulate forage production under grazing. The models are run for the next 90-day projection with current demand and projected temperature under no rain and high probability events derived from historical weather data. Projections of future forage balance are determined. If crops are located at the sampling point, then the APEX crop simulation model is run as well to make projections on emerging crop yields and potential failures.

Virtual landscapes currently being defined for each zonal weather station and PHYGROW parameterized for each plant community in the virtual landscapes and weather station combination. For each weather station, the ACT tool will be used to derive the mean monthly minimum/maximum temperature and precipitation for that site and those values entered in the weather generator file for a nearby WMO station to generate a 100-year weather file. Each zonal modal plant community will be run in PHYGROW with the 100 year weather file to set the benchmark mean ungrazed standing crop and mean grazed standing crop using local livestock movement decision rules. The LEWS teams are currently defining these modal plant communities in each zone. TAMU-LEWS will run all the long-term weather simulations while each of the zonal teams will run the 14-day weather sequences against the long-term benchmark forage supply values to set forage trends in a

zone. The simulated values will be provided to the CMO (Crisis Mitigation Office) at ILRI Nairobi where it is then passed to the TAMU-LEWS computing team to prepare the NDVI-forage supply maps that are passed back to the zonal coordinators via the CMO.

Zonal coordinators will also send the predicted CP and DOM values as well as animal performance by household location to the TAMU-LEWS team to link to the zonal NDVI values. Maps of diet quality and animal performance by class will be generated and passed back to the zonal coordinators via CMO. This protocol has been tested this year.

Predicted problem areas in terms of animal condition, forage balance and human activities are mapped and then weather and nutrition data are projected to other areas assumed to have similar effective environments to predict likely outcomes for those areas. Hot spots or emerging areas that are not part of the sampling routes are then investigated by rapid deployment teams in each zone to verify if critical conditions are truly emerging and warrant alert status. For those areas identified as alert status, a reporting mechanism is activated to link the information with existing early warning systems such as FEWS, GIEWS and the Climate Prediction Center of USGS as well as direct reporting to governmental entities responsible for policy making concerning disaster relief in each country. Initially, the USAID Famine Early Warning System (FEWS) and FAO Global Information and Early Warning System (GIEWS) 10-day reporting system will be used to predict rainfall amounts based on a complex calculation of elevation, distances to known rain gauges and remotely sensed cold-cloud cover. Predictions from the LEWS project will be fed back into the FEWS and GIEWS reporting systems and the ASARECA Crisis Mitigation office as it comes on line. Reporting mechanism with IGAD will be coordinated through CMO and the ASARECA network.

The primary development target of this program was to develop a livestock early warning system capable of providing information on emerging pastoral conditions 6-8 weeks earlier than current monitoring systems in East Africa. The resulting information on emerging problems will be provided to in-country policy makers, international monitoring network allowing for multi-directional flow of critical information. Timely spatial information on trends of livestock well-being allows for greater learning among pastoralists and policy makers leading to more rational decision making and reduced land degradation risk. The LEWS scientists in East Africa are placing a high priority on working with their respective governments, local communities to assure that information flows to the right people and that it is placed in context of other information sources that policy makers may contend with.

ROLE OF ANIMAL SOURCE FOODS IN IMPROVEMENT OF DIET QUALITY AND GROWTH AND COGNITIVE DEVELOPMENT IN EAST AFRICAN CHILDREN

This past year saw the successful implementation of the controlled school feeding intervention study in twelve rural Kenyan schools comprising ~525 first and second grade children. This included the careful and quantitative preparation of three different types of feedings, daily delivery of the feedings to the children during the three school terms of the year, the collection of all ongoing measurements, a one-year follow-up collection of blood samples for micronutrient analyses, and the successful collection of baseline data on a second cohort of children.

Data management procedures were established, and the Embu office now has a well-functioning data unit that is processing the approximately 47,000 data forms collected during the year with data transmission to UCLA, and analyses have begun.

Some notable problems that emerged included sporadic school attendance due to parents not able to pay school fees, and a drought that has been escalating for the past several months and that may have differential effects on the regions in the study area. We have been closely monitoring the household food situation and keeping the local government informed. So far relief intervention in the area has not occurred and the rains returned in late November 1999, with a harvest hopefully in January.

Field Operations:

This year began with the new Field Director, Dr. Edith Mukudi, firmly in place, and also saw the recruitment of additional staff in Kenya, including George Rabar, a computer programmer and consultant; Lillian Njue, a pediatric nurse; and four additional data entry staff. Total staff in Kenya now number 130 Kenyans and one German national. Staff training has been ongoing throughout the year.

The addition of a second cohort of ~500 Standard I children, and the collection of baseline data beginning in May was made possible by a National Cattlemen's Association grant. The food preparation building and shed were expanded in order to accommodate this

second cohort. Also, a reliable Toyota Landcruiser has been loaned to the project by the Pediatrics Department of the University of Nairobi, relieving the transportation shortage.

Data Management:

Accomplishments this year include the establishment of a streamlined data management system. Quality control procedures have been adhered to and staff retraining is ongoing to maintain high quality of the data collected. Careful error correction of data starts in the field by the supervisory enumerators and then by each function director, and overall quality and final checking is done by Dr. Edith Mukudi prior to data entry.

The Embu Data Entry Unit is headed by M. Grillenberger, who is responsible for all data entry aspects, range checking, data checking and correction, and transmission of data to the United States. Data entry is now current except for a backlog in food intake, which is now progressing well.

Analyses of baseline data have been completed and reveal that a third of the children are moderately malnourished, there is a high prevalence of anemia and endemic malaria as well as widespread micronutrient deficiencies. Analyses of the data collected during this first year of feeding are currently underway.

Leveraged Funding:

We obtained funding from the National Cattlemen's Beef Association for \$150,000 for two years to add a second cohort to the study. Also, six of the eight trips made to the project site by US team members were paid for by outside sources, including UCLA's International Studies Program, and UCLA's African Studies Center. We were, however, unsuccessful in obtaining leveraged funding from in-country sources such as UNICEF or USAID.

INTEGRATED TOOLS FOR LIVESTOCK DEVELOPMENT AND RANGELAND CONSERVATION IN CENTRAL ASIA

Recent market changes and privatization caused imbalances and dramatic reductions of agricultural stocks, production and productivity in Central Asian Republics (CAR). Central Asia represents a large region in the center of the Eurasian continent that encompasses the territories of Turkmenistan, Uzbekistan, Kazakhstan, Tajikistan and Kyrgyzstan. Rangelands occupy nearly 80% of the territory and provide the main source of forage for livestock. 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 winter forages, collapse of marketing networks and poor maintenance of livestock water wells have resulted in hand-harvesting of range plants for feed and fuel and concentration of livestock around populated areas and active wells. In spite of declining livestock numbers, rangeland degradation is accelerating near surface water and populated areas. Thus, this project addresses the immediate need to improve welfare of small landowners, and to prevent further deterioration of rangelands. We take an integrated multidisciplinary approach to improve the welfare of herders that involves not only on-farm solution of technical aspects, but also the assessment of alternatives and policy instruments to support them.

The GIS and Basic Resources subproject serves as the basis for regional application and modeling of research results. The main activities of this components are the creation of a GIS for Kazakstan, Turkmenistan, and Uzbekistan. Information is used for direct dissemination and as a basis for the other modules or subprojects. During the second year of the project we expanded the GIS for Kazakstan and started the compilation and digitization of data for Turkmenistan. A significant amount of time and resources were devoted to training, equipment, and acquisition of maps and weather information.

The main objectives of the Range Forage and Carbon Flux subproject are to: 1) quantify annual net primary production (ANPP) on representative Central Asian rangelands

and 2) assess the role of Central Asian rangelands in the global carbon budget. Accurate estimates of ANPP from these rangelands will provide important information on carrying capacity to sustain livestock production in the region. These estimates are also important for evaluating whether Central Asian rangelands are net sources or sinks for atmospheric CO₂. Degradation of rangelands and other ecosystems of Central Asia will likely result in a substantial release of CO₂ and other trace gases to the atmosphere with possible effects on the global CO₂ balance. On the other hand, rational management and improvement of these rangelands will not only increase their productivity to satisfy growing needs of the population, but also probably allow these lands to be a significant sink for atmospheric CO₂, contributing to a reduction in anthropogenic inputs of CO₂. Our studies in Central Asia will provide data necessary to quantitatively assess the role of Central Asian rangelands in the global carbon budget. Activities during 1999 resulted in the successful measurements of CO₂ fluxes in three sites which support the hypothesis that rangelands can sequester atmospheric carbon.

Under the Animal Production subproject, we conducted extensive analysis of data gathered in 1998. These data were distributed to collaborators the region, and a comprehensive report was prepared. Results confirm that most of livestock production in Kazakhstan takes place at a subsistence level and is most limited by availability of forages during the winter and early spring. Smallholder livestock production is largely depend upon range forage. Rangelands are overgrazed near villages and underutilized in more remote areas because of severe problems in availability and cost of transportation and livestock water. Alternative sources of feed are limited or not existent. Current breeding schedules lead to calving and lambing in mid-winter to early spring. Given the severe winter feed shortages reported in the central semidesert and southern foothills, it seems imperative that the breeding period be adjusted to reflect range forage availability in these regions. In the northern dry steppe. Outreach efforts to demonstrate the potential benefits of a later breeding schedule may increase understanding of this readily available means to coordinate livestock demand with range forage availability.

Activities in the Socio-Economics component of the project focused on the analysis of marketing of livestock. In Kazakhstan, the question of spatial integration of livestock markets was addressed because it has many policy implications. Without marketing orders, support prices, subsidies, and any kind of policy measures, the only platform on which producers perform their activity is the marketplace. The degree of market integration was studied with econometric models. Then, the behavior of the lamb market, which showed good

integration, was simulated by constructing a regional equilibrium model. The model was used to preliminarily test the effects of policies to improve transportation alternatives. Investments in the transportation systems would be favorable to the livestock sector and welfare of the general population, particularly when investments emphasize transportation by roads instead of train, and when the price elasticity of supply is increased by investment in livestock technology, production infrastructure, and credit.

In Turkmenistan, studies of the livestock sector indicated that state-owned enterprises are progressively and steadily ceding the sector to private producers and traders. State organizations face serious lack of cash and are not commercially oriented. Thus, they cannot reorganize into financially-viable entities and should not be further supported. Meanwhile, the private sector, both at the level of small-scale traders and large-scale manufacturing firms, is expanding without hindrance from the government. However, a sudden withdrawal of the state from livestock production would create problems as has been evident in Kazakstan, where livestock numbers plunged after rapid privatization of herds. The minimal amount of state support still given to production units) allows these to gradually hand over animals to shepherds through the leasing system. This leasing system gives shepherds the opportunity to gain experience to find the most cost-effective methods of managing and marketing livestock without having to own the whole herd. This system should be fostered by providing technical help and operational credit to those who lease animals. The wool market is suffering extremely deflated prices, because state organizations no longer provide wool grading and cleaning services. These services, as well as local cleaning and spinning of wool should be developed. Traders involved in marketing live animals have few constraints. A steady domestic demand for meat makes profit margins attractive. Trade is unrestricted, and costs are mainly in buying spare parts for the ancient trucks used to transport animals. However, traders indicated that one of their main problems was to get enough high quality feed to fatten animals. Although a private feed market exists, there is ample room for improvement of quality and reduction of costs through technical change.

IMPACTS OF ECONOMIC REFORM ON THE LIVESTOCK SECTOR IN CENTRAL ASIA

The project has two goals. First to expand understanding of the new forms of farm organization that are emerging and the economic and legal context in which this is occurring. Second, to develop technical options that increase the productivity of the livestock sector in environmentally friendly ways, specifically by increasing the meat productivity of the sheep flock. The following work was undertaken in year two:

The legal framework for agricultural privatization was traced in Kazakhstan, as was its impact in terms of the evolution of different types of farm organizations. Preliminary analysis of the first year of farm surveys (which concluded in September, 1998) in Kazakhstan, Kyrgyzstan, and Uzbekistan, was undertaken, and further analysis is ongoing. The second round of farm surveys was conducted in Kazakhstan and Kyrgyzstan (Uzbekistan was dropped) between April and September, 1999.

In the fall of 1999, the first marketing study of animal product processors and wholesalers was undertaken. The focus was on dairy and meat marketing in and around Almaty. A broad overview was obtained of the marketing situation, case studies of two leading firms were developed, constraints were identified and recommendations presented. This study was one springboard for the UW workshop, *Doing Business in Central Asia: the Case of Agribusiness*, held in Madison in November 1999. Follow-up studies are being planned with two Kazakh professors of agricultural economics who attended UW-Madison in fall, 1999, on a USDA grant.

Privatization has led to drastic declines in sheep numbers as farmers sold animals in order to buy other inputs and many animals were eaten for subsistence. The fall in wool prices has led to a reorientation of the sheep sector toward meat. On both accounts, the low reproductive rates of the region's finewool sheep are a problem. An increase in the number of lambs raised per ewe in finewool flocks can result in an increase in the number of replacement females produced in order to help rebuild national flock numbers as well as an increase in the amount of lamb meat produced per ewe. With a higher reproductive rate,

fewer ewes are required to produce the same amount of lamb meat. This results in less feed required to produce a kilogram of lamb meat and less pressure on range lands and other feed resources

A study is being conducted to evaluate the effectiveness of Kazakh and U.S. breeds of sheep to increase lamb production of Kazakh Finewool flocks through an increase in the number of lambs born per ewe. In the second year of the project, this work has focused on: 1) evaluation of lambs born from the 1997 and 1998 insemination by prolific breeds of rams, 2) implementation of management techniques to decrease lamb mortality and 3) evaluation of amino acids as components of ram semen diluents.

In general, lamb growth rates have been greater for lambs sired by the two U.S. breeds of Rambouillet and Polypay than for the two Kazakh breeds. Lamb growth is a factor in determining weight of lamb meat produced per ewe per year, but it is not as important a factor as the number of lambs raised per ewe per year. The real value of these breeds for improving the meat production of Kazakh sheep will be determined once the ewe lambs reach sexual maturity and enter lamb production in the spring of 2000, 2001, and 2002. Lamb mortality has been greatly lowered through strategically timed winter feeding of pregnant ewes, use of tincture of iodine on the navels of all lambs, and selected use of antibiotics as needed. The amino acid arginine was found to be a superior diluent for artificial insemination.

In January 1999 a conference was held in Almaty to present the work of this project and that of other researchers in the field. The Minister of Science opened the conference, other government officials were in attendance, and there was widespread media coverage. Proceedings were published in a 320-page Russian language volume and distributed in the region. A Russian language research paper was initiated with the first two papers. Research results were presented to government officials in nine different meetings.

POSTER PRESENTATIONS

STUDENT POSTER PRESENTATIONS:

Student authors of the following posters successfully competed for travel grants enabling them to attend and present their work at the GL-CRSP conference.

1. Market Reforms in Central Asia: Profiles of Private Farms and Livestock Production
2. The Snack That Is Helping In The Fight Against Hidden Hunger
3. Micronutrient Status of Schoolers in the Kenya Child Nutrition
4. Priority vegetation zones and areas for the conservation of endemic and threatened avifauna of southern Jalisco and Colima, Mexico.
5. Assessing Land-Cover and Land-Use Changes in a Biosphere Reserve in Mexico.
6. Biodiversity in Agroecosystems: Endemic Bird Habitat Assessment
7. Characterizing Local Participants in Crop Improvement and Livestock Intensification Activities in the Zenzontla Ejido, Jalisco, Mexico.
8. Methods of Collecting Time-Use Data in a Mexican Ejido and Ecuadorian Colonist Communities: A Comparative Study
9. Spatial Aspect of Livestock Marketing in Southern Kazakhstan
10. Landscape-scale organic carbon storage in North Kazakhstan's grain belt: consequences of agriculture (and opportunities)
11. Effects of Land-use and Land Tenure on Vegetation Changes within Rangelands: A Case Study in Greater Amboseli Ecosystem.
12. Policy and Ecology Impacts on Maasai Pastoralist Land Use Patterns: Implications for Conservation Policy in Multiple-use Areas
13. Spatial and Temporal Grazing Patterns of Livestock and Wild herbivores at Ngorongoro Conservation Area.

FACULTY POSTER PRESENTATIONS:

14. Addressing Management Questions for Ngorongoro Conservation Area using Savanna, an Integrated GIS-Simulation Modeling System
15. Effects of Conservation Policy on Human Well-being: A Comparative Study of Pastoral Maasai Nutrition and Economy in Northern Tanzania.
16. Human Nutrition Essential Component of Global Livestock CRSP

Author: Liba Brent
Organization: International Agricultural Program, University of Wisconsin-Madison
GL-CRSP Project: Impacts of Economic Reform on the Livestock Sector of Central Asia

Poster Title: *Market Reforms in Central Asia: Profiles of Private Farms and Livestock Production.*

Abstract: The study examines changes in the farm structure and livestock production in Kazakhstan and Kyrgyzstan that took place in the course of market reforms. Using survey data on 232 farms in Kazakhstan and 64 farms in Kyrgyzstan, the study examines profiles of private farms oriented towards livestock production that emerged after the dissolution of Soviet-style collective farms: private cooperative farms and private individual peasant farms. The statistical data on these two types of farms show that livestock, which was collectively owned prior to the reforms, has been distributed to cooperatives and then to individual peasant farms. The majority of these farms are single-household subsistence farms that have difficulties maintaining or increasing their herds. The study outlines the barriers to the development of livestock production on the new private farms. It concludes that large private farms that were able to accumulate diverse types of resources including technology, equipment, livestock, land, know-how, experience, personal contacts and diversify into a variety of other businesses than livestock-breeding have greater prospects for preserving their livestock with the possibility of producing for the market. The majority of small, single-household farms with few alternative sources of capital and income are often forced to consume and barter their livestock. These farms may eventually cease to exist and the farmers may become hired labor on the large farms or move to the city.

Author: Constance Awuor Gewa
Organization: University of Nairobi, Kenya.
GL- CRSP Project: Child Nutrition Project, Embu, Kenya.

Poster Title: *The Snack That Is Helping In The Fight Against Hidden Hunger.*

Abstract: In Kyeni Division, Embu District, 70 percent of children aged 7 - 8 years attend school. Frequently these children leave home hungry and walk a considerable distance to reach the school. The CNP snack supplements the calorie and micronutrient intake reported to be deficient in this community (Neumann et. al. 1987). "Githeri", the staple food of the Embu people forms the basis of preparing the different snacks that are served in the schools. The community identifies with procedures used to prepare the CNP snack, hence it is not a foreign idea. These snacks are:

- Plain fried githeri
- Fried meat githeri
- Fried githeri and milk

The snacks have been enriched with green vegetables and iodized salt. The food is served in individual child dishes, packed and delivered to schools. Feeding is at .9.30 am. This time ensures lack of interference with the children's normal lunch intake.

The CNP snack has helped improve school attendance and increase the children's activity and participation levels (unpublished reports from various teachers). If shown to be effective, the CNP snack production could be replicated in the various school kitchens. Keeping of a few animals e.g. Goats and rabbits could encourage the consumption of animal products.

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Organization: University of California, Davis¹; University of California, Los Angeles²;
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GL-CRSP Project: Child Nutrition Project

Poster Title: *Micronutrient Status of Schoolers in the Kenya Child Nutrition*

Abstract: As part of the Kenya Child Nutrition Project study to improve micronutrient (MN) status through supplementation with animal products for 12 months, we collected baseline data from 530 Kenyan schoolers age 6-9 y in 12 schools. Baseline samples indicate a high prevalence of anemia (60%, hemoglobin < 120 g/L), and of deficiencies of vitamin A (90%), B-12 (30%), and zinc (50%), but not folate. Assessment of nutrient status is potentially confounded by malaria, specifically ferritin. Only 13% of anemic children had malaria parasites, yet serum iron was low in 30% and ferritin concentrations were normal-to-high in 90%, even when the 20% with elevated CRP values were excluded. Malaria infection predicted higher plasma ferritin and lower zinc, but not differences in the other nutrients. We conclude that these children have multiple MN deficiencies but their iron status is unclear. Analysis of post-intervention samples for MN status is currently in progress.

Author: Sarahy Contreras-Martinez
Organization: Instituto Manantlán de Ecología y Conservación de la Biodiversidad,
Universidad de Guadalajara, CUCSUR
GL-CRSP Project: Planificación Local de la Naturaleza y Agropecuaria. (Livestack-Natural
Resource Interfaces at the Internal Frontier in Latin America)

Poster Title: *Priority vegetation zones and areas for the conservation of endemic and
threatened avifauna of southern Jalisco and Colima, Mexico.*

Abstract: We describe the status of conservation and distribution of bird species in southern Jalisco, Mexico, and relate it to environmental and political characteristics of the landscape. ArcView 3.1 Spatial Analyst was utilized for the manipulation of spatial and distribution data of birds. GIS mapping database was used to design recommendations for a regional management strategy for the conservation of endemic, endangered and threatened bird species in the region. A distributional map of 50 endemic and 25 threatened/endangered species was developed based on their altitudinal distribution and habitat affinity. The boundaries of the municipalities and protected areas of southern Jalisco were also overlaid over the distributional maps in order to show gaps where these species are not protected. It was found that the distribution of these birds is related to both altitude and vegetation type. The three protected areas in the region harbor 91% of these priority species, thus they are located in places where they can potentially be effective in achieving their conservation. However, the areas of highest endemism in the region are presently outside of protected areas, and thus in a greater likelihood of being threatened. The association of areas important to the conservation of these birds with municipalities that have high indicators of poverty, suggest that bird conservation in the region must be part of a transectorial strategy that is linked to poverty alleviating programs.

Author: Oscar G. Cardenas
Organization: IMBECIO, Universidad de Guadalajara, CUCSUR
GL-CRSP Project: Livestack-Natural Resource Interfaces at the Internal Frontier (PLAN)

Project Title: *Assessing Land-Cover and Land-Use Changes in a Biosphere Reserve in Mexico.*

Abstract: This study presents an evaluation of regional land-use and land-cover changes in the Ejido Zenzontla, a rural community located in the Sierra de Manantlan Biosphere Reserve in western Mexico. Research findings were based on a multi-method and multi-date data collection approach. Ancillary and remotely sensed data, including satellite imagery, were integrated and analyzed utilizing a Geographical Information System (GIS) in order to detect land-cover and land-use changes in the area from 1970 to 1993. The results show that there has been a significant decrease in the surface covered by tropical deciduous forests in the ejido because of the expansion of agricultural areas and grasslands (principally pastures). This approach provides a reliable database for the analysis of land-use and land-cover changes in this area. However, it will be necessary to combine remote observations with ground-based social data in a further investigation, in order to improve the understanding of the factors that cause changes in the use of land in the region.

Translation: *Análisis de los Cambios en Cobertura Vegetativa y Use del Suelo en una Reserva de la Biosfera en México*

Este estudio presenta una evaluación de los cambios regionales en cobertura vegetativa y uso del suelo en el ejido Zenzontla, una comunidad rural localizada en los límites de la Reserva de la Biosfera Sierra de Manantlán, en el occidente de México. Para este trabajo se utilizó un enfoque multi-método y multi-fecha. Para detectar los cambios en la cobertura vegetal y el uso del suelo en el área durante el periodo 1970-1993, se utilizó información obtenida a través de sensores remotos (incluyendo imágenes de satélite) e información auxiliar, las cuales fueron integradas en un Sistema de Información Geográfica (SIG) para el área. Los resultados muestran que ha habido un crecimiento significativo de las áreas agrícolas y pastizales, en detrimento de las áreas boscosas. Este tipo de aproximaciones proveyó las herramientas necesarias para el análisis de los cambios en cobertura y uso del suelo en el área. Sin embargo, será necesario integrar en futuros estudios las observaciones realizadas con sensores remotos, con información socioeconómica para poder entender mejor los factores que ocasionan estos cambios, así como sus consecuencias socioambientales.

Author: Yoyi Hernandez
Organization: University of Wisconsin – Madison
GL-CRSP Project: Livestock-Natural Resource Interfaces at the Internal Frontier in Latin America (PLAN)

Poster Title: *Biodiversity in Agroecosystems: Endemic Bird Habitat Assessment*

Abstract: This study assessed species composition, richness, and abundance of resident birds in dry forest habitat in the ejido Zenzontla, Sierra de Manantlán Biosphere Reserve, Jalisco, Mexico. The dry tropical forest of Zenzontla exists as patches embedded within a matrix of agriculture. Eight forest patches, each differing in age, vegetation structure, and management history, were selected and censused for birds using the pint count technique during the summer of 1999. Data on vegetation structure were also collected.

Zenzontla's dry forest is highly disturbed and fragmented. Nevertheless, informal censuses of birds in this area have produced a list of over 90 species, including 19 Mexican endemics. Preliminary analysis of the data collected in this study indicate that endemic species, including several of conservation concern, are present throughout the forest-agriculture matrix, particularly in denser riparian areas that have not been subjected to clearing. Additional data on bird productivity and survivorship in these patches are needed. However, results of this study suggest that it may be possible to preserve these birds, and their important dry forest habitat, within an agricultural matrix using careful habitat management that protects key areas, rather than the more expensive and socially challenging conservation strategy of buying up and setting aside large blocks of habitat.

Author: Alexis Eakright
Organization: University of Wisconsin – Madison
GL-CRSP Project: Livestock-Natural Resource Interfaces at the Internal Frontier in Latin America (PLAN)

Poster Title: *Characterizing Local Participants in Crop Improvement and Livestock Intensification Activities in the Zenzontla Ejido, Jalisco, Mexico.*

Abstract: Identifying farm household characteristics which positively influence participation in extension and development activities is vital for organizations attempting to change the way in which local communities utilize their natural resources. This study employed general surveys, observations, recall interviews, focus groups, and a game, the “Juego de Registro”, to construct portraits of six participant and six non-participant households in the Zenzontla ejido, Jalisco, Mexico. These portraits include family history, structure and stage, productive and reproductive activities, past and current land holdings and land use, time and labor allocation, amount and control over income, and decision-making within the household. The case studies provide useful insights into how participation in agricultural extension and development activities fits into household economic logic, and allow for the formation of testable hypotheses regarding incentives and constraints to participation and the adoption of alternative technologies. For example, participant families seem to have access to more family labor. They are the more economically diversified and innovative households, and tend to have higher quality land holdings near the valley floor, while farmers with marginal mountainside parcels are noticeably absent from participation. Participation is also overwhelmingly male. Such observations can help guide development projects towards appropriate avenues for activity expansion.

Author: Kari Rojas
Co-Author: Alexis Eakright
Organization: University of Wisconsin – Madison
GL-CRSP Project: Livestock-Natural Resource Interfaces at the Internal Frontier in Latin America (PLAN)

Poster Title: *Methods of Collecting Time-Use Data in a Mexican Ejido and Ecuadorian Colonist Communities: A Comparative Study*

Abstract: With limited budgets and time, many researchers face difficult decisions regarding appropriate data collection techniques. This study, carried out in both the Zenzontla ejido, Jalisco, Mexico, and newly colonized areas of the Cosanga River watershed in Ecuador, examines five methods for time-use data collection: general time-use interviews, recall interviews, days of observation, the game “Juego de Registro”, and focus groups. The study sites in Mexico and Ecuador contrast in ways such that the techniques appropriate for recording time-use differ. The Ecuadorian communities are in areas of soggy, steep terrain with uncertain land tenancy, causing daily travel to agricultural lands to be long, arduous and risky, and resulting in a longer workday. A sense of community is practically non-existent. In the Zenzontla ejido, land tenancy is well established, agricultural plots tend to be more accessible, and the community is relatively well organized. Experience in Cosanga indicates that interviews and observation days are more practical and accurate, while the game is too time consuming for research subjects, and focus groups are nearly impossible to coordinate. While interviews also work well in Mexico, focus groups and the game are more practical alternatives. These and other observations provide insight into appropriate methodological approaches in social science research depending upon local circumstances.

Author: Mimako Kobayashi
Organization: University of California, Davis
GL-CRSP Project: Livestock Development and Rangeland Conservation Tools

Poster Title: *Spatial Aspect of Livestock Marketing in Southern Kazakhstan*

Abstract: As in other former Soviet Union countries, decollectivization of state and collective farms has resulted in the creation of smaller units of agricultural production in Kazakhstan. Although low profitability in livestock production prevails throughout the country, most rural households continue to raise livestock. One reason is to accumulate wealth in the form of animals so as to smooth consumption over the year, since they have virtually no alternative way of storing wealth. They usually sell animals when they need cash. Once small farmers decide to sell their animals, the marketing environment is fairly competitive. They usually sell their animals in animal bazaars, which are held once or twice a week at the oblast, raion, and village levels. If possible, the farmers decide where to sell by comparing prices of different markets and taking transport costs into consideration. Our primary question is: how does such small-scale marketing “connect” geographically dispersed livestock markets? Market connection should prevent sharp consumption falls when deficit occurs in one place. It also should promote efficient utilization of resources (pastures) across space. We construct a spatial model of livestock marketing for Southern Kazakhstan. Preliminary results suggest that only those markets close to large cities are connected. We extend the model to incorporate the flexibility of the farmers’ supply response when profitability changes. We also consider the possibility of exports of livestock from this region.

Author: Adam Wolf
Organization: University of California, Davis
GL-CRSP Project: Livestock Development and Rangeland Conservation Tools

Poster Title: *Landscape-scale organic carbon storage in North Kazakhstan's grain belt: consequences of agriculture (and opportunities)*

Abstract: Prairie soils in northern latitudes are one of the largest global pools of stabilized carbon. Organic soil carbon at large scales is important as a means to offset atmospheric carbon emissions. This research quantifies the distribution of organic carbon at the landscape scale based on soil management and effects of topography and wind on precipitation redistribution. In order to assess the effects of landforms and cultivation, three transects were taken across an entire 23 km catena that has a variety of landscape forms and soil management histories. At 1 km intervals, a 10 m gridded set of samples was taken at three depths; differing scales allow segregation of large-scale landscape effects on carbon such as snow redistribution from small-scale effects such as water runoff from minor undulations. Soil C was analyzed by stable-isotope gas chromatography. Isotope ratios ($^{13}\text{C}/^{12}\text{C}$) and mass of C will indicate long-term patterns of water incidence across the landscape. A landscape model of soil organic carbon will be developed using GIS, so that experimental results can be extrapolated for the region. Policy makers can use these results to assess economic benefits and tradeoffs associated with reducing the region's cultivated area for the purpose of carbon sequestration.

Author: Fred Atieno
Organization: University of Nairobi/ILRI – Kenya
GL-CRSP Project: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity (IMAS)

Poster Title: *Effects of Land-use and Land Tenure on Vegetation Changes within Rangelands: A Case Study in Greater Amboseli Ecosystem.*

Abstract: Assessment and description of the rate and effects of changing land tenure and land-use systems on vegetation enhances our understanding of ecological dynamics relevant for national policy formulation and integration of the often conflicting multiple uses within rangelands. The objective of this study was to map land cover types, their changes and effects on vegetation within 3,112 Km² of Amboseli ecosystem in Kenya. Remote sensing, GIS and field techniques were applied.

Land-use and land-cover maps for 1988 and 1998 were produced with an accuracy of 85.7%. During the ten-year period, changes in natural vegetation cover and cultivated fields were significant ($p < 0.05$) with cultivated fields replacing 8% of natural vegetation. Cultivation increased along the mountain slopes, rivers and swamps: - areas formerly used by pastoralists and wildlife for dry season grazing. Land-cover types changed significantly with bushed grassland and cultivated fields increasing by 10% and 8%; while grassland and bush land decreased by 6% and 11% respectively. Overall result is change in landscape structure with increasing patch diversity and mixtures of land-use and land-cover types attributable to changes in land tenure policies and pastoralists' economic lifestyles. This trend poses greater threats to wildlife conservation and survival of pastoralism in East Africa.

Author: Stacy Lynn
Organization: Colorado State University, Natural Resource Ecology Laboratory
GL-CRSP Project: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity (IMAS)

Poster Title: *Policy and Ecology Impacts on Maasai Pastoralist Land Use Patterns: Implications for Conservation Policy in Multiple-use Areas*

Abstract: The Maasai pastoralists of the Ngorongoro Conservation Area (NCA) of northern Tanzania believe that local multiple-use conservation policy has compromised their well being, primarily through 1) direct and indirect restrictions on traditional livestock movement patterns and management practices, and 2) limitations on crop agriculture. The Loliondo Game Controlled Area provides a control for the study of policy effects upon Ngorongoro Maasai. Although the NCA and Loliondo regions appear to differ primarily because conservation policy is less restrictive in Loliondo, ecological differences must be measured, accounted for, and incorporated into policy analyses. I collected data on land-use, human welfare, and landscape-vegetation properties through interviews and ecological surveys in both study areas from June through December 1998. Human welfare is quantified from household-level data on per-capita livestock numbers and cultivated acreage. Analyses indicate that Loliondo Maasai have significantly higher per-capita livestock numbers and cultivated acreage than Ngorongoro Maasai. Additionally, Geographic Information Systems analyses indicate ecozone landscape differences between the two areas. Land-use and human welfare differ among ecozones, with the possible implication that landscape variations contribute to observed differences in human welfare; welfare of Ngorongoro Maasai appears to be a function of landscape effects combined with or magnified by land-use policy restrictions.

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GL-CRSP Project: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity (IMAS)

Poster Title: *Spatial and Temporal Grazing Patterns of Livestock and Wild herbivores at Ngorongoro Conservation Area.*

Abstract: Livestock and wildlife distribution on rangelands can be affected by many factors, some of which are site related. This is what initiated a study on Spatial and temporal grazing patterns at Ngorongoro Conservation Area with the objective of producing patterns of livestock and wild herbivores. The sampled sites were the Crater, Malanja and Esilwa. Data collection was based on the use of a quadrat of 0.25m² and cage comparison method on paced transects. Forage samples were analyzed for chemical composition. Soil tests were carried for pH, Phosphorus, organic matter and cation exchange capacity. Slope was determined using a clinometer.

Soil results indicate that, the Crater and Malanja were more fertile than Esilwa and the forage results confirm these findings. The rainy season had a significant effect ($P < 0.05$) on forage yield and chemical composition. CP was high for all the three sites but didn't change with season at Esilwa. Likewise ADF was high during the dry season for both the Crater and Malanja sites but was not the case for Esilwa. NDF was high at the Crater and Malanja in both seasons but was significantly lower at Esilwa. ADL was high during the dry season for Malanja and the Crater but was significantly ($P < 0.05$) lower at Esilwa in both seasons. The reason for the differences in chemical composition between Esilwa and the other two sites (Malanja and the Crater) could be because of more forbs being included in the samples from the poor range at Esilwa. The other reason was that, the dominant grass species on the sites were usually more stemy than on other sites. This was also true for ash, which was slightly higher at Esilwa than the other two sites. The Crater was dominated by

Chloris, *Pennisetum*, and *Cynodon spp.* while Malanja had *Cynodon*, *Andropogon*, and *Themeda* and Esilwa had *Themeda*, *Hyparrhenia*, *Setaria spp* and *forbs* in that order of abundance. Water situation at the Crater was ideal. There were rivers, springs, marshes and a lake at the center. Water at Malanja was seasonal and fills up during the wet season. Livestock and wild herbivores at Malanja depend on the Crater for their water requirement in the dry season. Water distribution was poor at Esilwa. Animals had to walk more than 6 km down the slopes toward lake Eyasi for water. Both the Crater and Malanja had fewer animals during the dry season compared to the rainy season. Wild herbivore figures for Esilwa could not be obtained. Grazing patterns were observed in the Crater, Malanja, and Esilwa through utilization levels. Distinct patterns were observed in the Crater from the most utilized area at Leraï to the least utilized area at Seneto. The second most utilized area was Ngoitoktok followed by Munge in the Crater. Out of the three sites Esilwa was the most utilized site and Malanja was the least utilized whereas, the Crater was moderately utilized. Differences in these patterns were attributed to differences in forage yield and species composition, territorial occupation by herbivore species, condition effect on forage yield and chemical composition. Other site-related factors, which affected utilization patterns, were slope, soil fertility and distance to water. The average area cover scores (herbage and bare soil) were the Crater 87 %. Malanja 86% and Esilwa 60%. Esilwa is predominantly a Maasai domain and showed the highest utilization pattern (30%) among the three ecological zones. The utilization pattern is a result of human judgement in driving animals within the area. It was concluded that, food availability, quality, site factors and season are key elements in determining grazing patterns. However where human judgement override the decisions of herbivores, grazing patterns may take different images resulting into relatively poor range condition, as is the case at Esilwa Further investigations are needed to determine species preference and chemical composition of individual plant species. A thorough range inventory of the Crater and surrounding areas is needed.

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GL-CRSP Project: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity (IMAS)

Poster Title: *Addressing Management Questions for Ngorongoro Conservation Area using Savanna, an Integrated GIS-Simulation Modeling System*

Abstract: Ngorongoro Conservation Area (NCA), in northeastern Tanzania, was created explicitly as a multiple-use area, with both wildlife conservation and human welfare to be considered. Large-scale changes in NCA have occurred, such as wildebeest numbers tripling to about 1.5 million at their peak, agriculture outlawed, then reinstated, and increasing Maasai populations becoming more sedentary. We used Savanna, a loosely linked GIS and ecological modeling system to assess management options in the NCA ecosystem. The model was parameterized to describe responses of seven plant groups (e.g., grasses, forbs, evergreen trees) and eight animal groups (e.g., cattle, wildebeest, goats and sheep, giraffe). A model run was conducted based upon recent conditions for use in comparisons, for the period 1973 to 1988. Then a series of six types of management questions were addressed; three of these types of questions were addressed simply by modifying the GIS data used, and we present a summary of these analyses. When drought was modeled, annual net primary productivity, herbaceous biomass, livestock populations, and wildlife populations were reduced during the dry period. Maasai may not graze livestock in Ngorongoro Crater through legal restrictions. Allowing livestock to graze in Ngorongoro Crater added a few thousand cattle to the population, but those present maintained body weight. Livestock were allowed to graze in the southwest, where they are currently excluded because of theft. Several thousand more cattle could be supported if security was improved, but

the elephant population declined more than 13%. More cattle could be supported in the system with an improved water supply, but these additional cattle competed for forage with goats and sheep, reducing their populations. In a series of meetings, these results were shown to managers from East Africa. Feedback was favorable, but comments spawned the following ongoing improvements: 1) increase plant biomass estimates, 2) further divide animal groups, and 3) include density dependent effects from disease when modeling animal populations.

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GL-CRSP Project: Integrated Modeling and Assessment for Balancing Food Security, Conservation and Ecosystem Integrity (IMAS)

Poster Title: *Effects of Conservation Policy on Human Well-being: A Comparative Study of Pastoral Maasai Nutrition and Economy in Northern Tanzania.*

Abstract: Conservation and human biology have been a focus of interdisciplinary research in the Ngorongoro Conservation Area (NCA), Tanzania where Maasai pastoralists live with a diverse and concentrated wildlife population. In previous papers we ascertained that overall nutritional status was low for Maasai in the NCA. However, we could not attribute their state to conservation policy. With new data for Maasai outside and inside the conservation area we now can explore the causes for any observed differences in human nutrition.

We collected anthropometric data during the summer of 1998 in the NCA (n=100) and in the area north of the NCA, Loliando district (n=306). Males and females between the ages of birth to 50 years of age were sampled. We compared measures of Loliando Maasai nutrition to those of NCA Maasai in our earlier research (n=600). Body mass index (BMI) scores for NCA women averaged 19.2 (n=121) and Loliando women's BMI scores (n=122) were also 19.2 on average. The women from Loliando weigh more (49.7 kg vs. 46.6 for NCA Maasai) and are taller on average (1.58m vs. 1.56 m) than are the NCA Maasai sample. Men's BMI scores were 19.3 (n=139) for NCA and Loliando's were 19.7 (n=25). Loliando men also weigh more and are taller than are men from the NCA.

We will explore the implications of these nutritional data and those from children for human welfare to determine if the NCA Maasai actually are compromised by conservation policy as they allege, or if their situation is similar or superior to that of the Loliando Maasai who are not constrained by conservation policy.

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Poster Title: *Human Nutrition Essential Component of Global Livestock CRSP*

Abstract: The ability of animal source foods (ASF) to meet human nutritional needs, especially those of women and children, is being examined by the Global Livestock CRSP in three regions. A controlled intervention is being conducted in East Africa to determine the benefits of ASF consumption. The project headed by University of California, Los Angeles will definitively test the link between ASF and cognitive and physical development in children. Additional project work, after testing, will consider the effectiveness of different interventions in delivering ASF into the diets of children. Also in East Africa, projects headed by Colorado State University and Utah State University are considering the nutritional status of women in recommended policy interventions based on their investigations. In Central Asia, the University of California, Davis project is investigating the allocation of nutritional resources within the household, considering how alternative interventions would affect the nutrition of women and children, and proposing new technologies to improve the nutritional status of families. In Latin America the project headed by University of Wisconsin-Madison is working with local communities in the design and development of a sustainable livestock production program which includes attention to improved diets and provision of adequate human nutrition. The GL-CRSP projects are being developed collaboratively to share baseline data and to maximize the comparative potential of intra- and inter-regional studies. The linking of increased animal production and the improved physical and cognitive development of rural populations is a major theme of Global Livestock CRSP research and development efforts.

From the 5-year grant renewal proposal, July 1998:

GLOBAL PLAN: MANAGING RISK

The Small Ruminant/Global Livestock Collaborative Research Support Program (SR/GL-CRSP) is an international program of agricultural research and development. Funded by United States Agency for International Development (USAID) under Title XII of the International Development and Food Assistance Act of 1975, the program focuses on the food security and nutritional needs of low-resource rural populations. The intent of Title XII is “to prevent famine and eliminate hunger” by employing the efforts of U.S. land-grant universities to address the food and nutrition problems of developing countries. Title XII observes that land-grant universities have a demonstrated ability to work with institutions abroad to expand production “for both domestic and international markets.” It also states that international research and development have benefited “agriculture in the United States.”

While the SR/GL-CRSP is an expanded program targeting issues in animal agriculture in general, it builds on the past success of the Small Ruminant CRSP (SR-CRSP). (See Appendix C). The CRSP framework, a framework which has served a succession of programs, was developed by the SR-CRSP in 1978. The SR/GL-CRSP continues this pioneering tradition by establishing a new process for meeting the demands of a changing research and development environment. This new process recognizes that: 1) research imperatives have become regional and global in nature; 2) extension of research results is determined in large part by the unique circumstances of different locales; and 3) impact can be maximized through creative partnerships among governmental, non-governmental and private agencies.

MISSION STATEMENT

The SR/GL-CRSP will support long-term collaborative research projects which address problems of “food production, distribution, storage, marketing, and consumption” affecting low-resource producers. Environmentally-sound livestock development, led by U.S. land-grant universities in selected regions, will aim to enhance the well-being of producers. The

capacity of U.S. institutions to meet the needs of farmers and consumers in the United States will also be advanced.

PROGRAM GOAL

The goal of the SR/GL-CRSP will be to increase food security and improve the quality of life of people in developing countries while bringing an international focus to the research, teaching and extension efforts of U.S. institutions. This goal will be met through collaboration between U.S. land-grant institutions and national and regional institutions abroad that are active in livestock research and development.

STRATEGIC OBJECTIVES

To achieve this goal, the following objectives have been identified:

- To strengthen the ability of institutions in developing countries to identify problems in livestock production and develop appropriate solutions.
- To increase employment and incomes among livestock producers and associated value-adding agribusinesses.
- To improve livestock production while monitoring the effects of production on the environment and exploring the integration of production systems with the rational use of natural resources, such as wildlife.
- To enhance the nutritional status of targeted populations through increased availability and utilization of animal source products.
- To provide support to decision makers in developing policies that will promote livestock production, marketing, and processing of animal products; human nutrition and child physical and cognitive development; and natural resource conservation and management.
- To identify, study, and strengthen communication systems (including but not limited to extension) among livestock producers, businesses, researchers, and consumers.

RESEARCH PLAN

The world confronting the international development community today appears radically different from the world in which development efforts began. While the urgency of food security persists, our increased knowledge of what food security requires, in a rapidly changing global environment, reveals the multiple dimensions of the task ahead. Although the advances of the Green Revolution have been dramatic, resulting in significantly greater food production, increased availability of food alone will not resolve the problem of global food security. The pressure of populations growing at high rates has put enormous stress on an increasingly fragile resource base. Even where food is abundant, many lack the income or the assets to purchase or produce food. Studies have also shown that the health and well-being of individuals, families and communities depend not only on the quantity but also on the quality of food.

The approach of the SR/GL-CRSP to international research and development focuses effort at the community level and seeks to involve communities in all stages of project implementation. The goal of this effort is to enhance the capacity of communities to develop and to respond effectively to change. In many developing countries, the small-scale farm sector comprises up to 80% of the population. These areas represent both the highest potential for increases in global food production and the greatest threat to maintenance of a viable resource base. Enhancing the health and welfare of small scale producers through environmentally sound agricultural development is essential for securing global peace and prosperity.

The success of community-based livestock development will depend largely on the policy environment within which interventions are carried out. In many countries, the transition to a market economy and more open and liberalized political systems has brought the active participation of interest groups at all levels of decision making. CRSP projects are designed to identify, evaluate and recommend policies with respect to needs at each level. A concerted effort has also been made to involve policy decision makers in projects from the

beginning of project planning. Policy analysis will be a major part of project implementation, and feedback on policy issues will be solicited throughout the research and development process.

GLOBAL PROGRAM

While the role of livestock in research and development figures differently from region to region, many of the methodologies to be used in funded projects and the overall complex of development needs are similar. Projects in all three regions bring new, sophisticated analytical tools to the table and propose innovative means for linking research and development. Land-use studies balancing food security needs and environmental concerns are underway in three regions; studies linking livestock development and overall economic growth have been undertaken in East Africa and Central Asia; human nutrition is being incorporated as an essential component in all projects; and the study of global warming to be conducted in Central Asia has international significance.

Enhancing Research and Development Through use of Spatial Tools

Five of the seven funded projects are developing highly sophisticated spatial modeling tools that will enable integrated assessments of complex problems and evaluations of alternative mitigation or development strategies. Texas A & M University System (TAMUS) is integrating a variety of tools to enhance the early warning capacity of existing systems in East Africa. The project's Spatial Characterization Tool (SCT) enables spatial organization of diverse types of information, from soil, weather and biological data to policy, cartographic and demographic information and functions. Spatially explicit information generated by such systems can be used to visualize the impact of various kinds of change at multiple levels of decision making. Spatially explicit information and its analysis are a major breakthrough in the analysis of landuse and ecosystem scale problems. The scientists in the CRSP project have a high level of sophistication and expertise in spatial analysis that will be a major resource for the land-use and environmental components of the CRSP work. A workshop in Fort Collins (April 1998) was organized by the TC to acquaint all CRSP researchers with the spatial tools and methods being used by the projects, determine opportunities for standardization and collaboration and plan an agenda for future communication. In addition to enhancing research through improved analytical capacity, projects are developing

innovative mechanisms for linking research and development. Some projects are working directly with community-based organizations. Other projects are linking research and development by working through action agencies (both governmental and non-governmental).

Wildlife Conservation, Managed Land Use and Maintenance of Ecosystem Integrity

The Colorado State University (CSU) project in East Africa and the University of Wisconsin-Madison (UW-Madison) project in Latin America concentrate on the dynamics of different ecosystems: pastoral-agropastoral ecosystems and montane forested ecosystems, respectively. While the ecological base is different, the problem is essentially the same: the managed expansion of livestock production into environmentally protected areas, to increase the incomes and food security of local populations. In Latin America, a strong correlation between cattle density and deforestation highlights the need for managed expansion of livestock production and careful environmental monitoring. In Africa, there is strong support for balancing pastoral production needs with conservation of wildlife. In areas where expansion of agricultural production poses a threat to the environment, whether on arid or semi-arid lands or in forested mountains, integrating livestock and crop systems can be an effective means of intensifying agriculture.

Strategic Support for Economic Growth

While all CRSP projects are livestock-related with the goal of improving production, the benefits to be gained from increased production are dependent on effective integration into a complex of systems which interface with the livestock production system. The Utah State University (USU) project in East Africa examines this problem directly, by identifying four enabling systems: resource tenure, marketing, rural finance, and public service delivery. Through development of risk management strategies, the USU project seeks to link improvements in pastoral welfare to overall growth in the national economy. The UW-Madison project in Central Asia looks at many of the same issues, although regional political and economic instability, institutional fluidity, and the problems of distance and communication limit the scope of work that can be done. The projects in Central Asia will establish a baseline for economic studies, upon which more integrated efforts might be launched.

Food-Based Approaches to Micronutrient Deficiencies

The human nutrition studies of the SR/GL-CRSP will be led by the project in East Africa managed by the University of California, Los Angeles (UCLA). The UCLA project will implement a controlled study to establish the relationship between consumption of ASF and child health and development. Findings of the former Nutrition CRSP, in which many of the current project's team members participated, revealed a correlation between animal source foods (ASF) and child physical and cognitive development. An experimental intervention is necessary to prove this link and to determine whether ASF are important because of caloric or micronutrient content. A third objective of the study is to compare the respective benefits of meat versus milk. These issues are integral to enhancement of human welfare in all projects across the CRSP.

Significance of Introduced Pastures for Mitigation of Global Warming

The rangelands in Central Asia represent a significant portion of the total arid land area of the world. The processes occurring in this area, especially changes in carbon fluxes and reserves resulting from changes in cultivation, grazing use, and other forms of human activity (including dropping of the level of the Aral Sea and its consequences) may have regional as well as global significance. Quantitative data on net direction (accumulation or release) and rates of carbon flux on Central Asian rangelands, to be collected by the UCD project, will contribute to an improved understanding of the global carbon cycle and its modification by humans. Transformation of 10 million hectares of abandoned farm lands into introduced pastures could result in both a significant resource for livestock production and a sink for atmospheric CO₂.

REGIONAL PROGRAMS

While the SR/GL-CRSP global program builds effectively on complementarities between projects in different regions, each region has a set of unique development problems. The East Africa program focuses primarily on pastoral societies coping with climatic unpredictability and diminishing resources for mitigating risk. The Central Asia program addresses a rapidly changing and unstable political and economic environment, where little effort has been made, particularly in rural areas, to “cushion” the effects of transition to a market economy. The Latin America program faces sustainability issues, with a growing

population, more firmly entrenched poverty, and a rapidly diminishing resource base.

The organization of regional programs is also unique and appropriate to the circumstances of each region. In East Africa, three projects focused on pastoral systems tie into the three objectives of the ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa) Crisis Mitigation Program. The ASARECA tie-in gives the program regional coherence. In Central Asia, a collaborative network of organizations has been formed by linking the UCD and UW-Madison projects with the BASIS CRSP, ICARDA (International Centre for Agricultural Research in Dry Areas), IFAD (International Fund for Agricultural Development), and the ODI (Overseas Development Institute). The organization of research and development in Central Asia will be facilitated by a Livestock CRSP Specialist, who will be assigned to work in the Agricultural Research and Extension Group (ESDAR) at the World Bank. Finally, in Latin America, the one project funded is exceptionally broad-based, with extensive institutional linkages in each country of operations (Mexico, Bolivia and Ecuador).

NEW INITIATIVES

A Task Force appointed by the Gore/Chernomyrdin Commission (GCC) and funded by the SR/GL-CRSP visited the Russian Federation (Russia). The purpose of the trip was to explore the possibility of university partnerships between the U.S. and Russia, and possibly also the U.S. and Ukraine. The Task Force recommended institution of such a program, with an initial focus on revival of the animal industry.

SR/GL-CRSP has also identified additional opportunities in which it has a comparative advantage based on its ongoing projects in other regions. A program for Mongolia is proposed that will strengthen the livestock sector, conserve biodiversity and reduce rural poverty by combining approached employed with pastoral systems and natural systems in East Africa and Central Asia. Indonesia represents a special case where timely and urgent intervention is needed to support a floundering but critical livestock sector. A US-ASEAN Business council trip has made recommendations and support a program proposed by the SR/GL-CRSP.

Common development objectives of both the USAID/CRSP and Agricultural Research and Extension Group (ESDAR) could be furthered by seconding a Specialist to the World Bank. The Specialist would address those objectives held in common, namely: Development of regional agricultural networks for Central Asia, development of research linkages and collaborative research activities, and coordination of technology system development activities and donor assistance to developing country NARSs. In the case of the Livestock CRSP Specialist, work would focus on livestock research-related activities. A U.S. academic would fill the position on sabbatical leave from their university.

KNOWLEDGE MANAGEMENT AND GLOBAL INTEGRATION

Knowledge is useful for two purposes. First and most practically, new knowledge is the basis for effective intervention to solve problems and stimulate development that enhances the quality of life. Second, new knowledge provides the groundwork for more effective study of problems to permit future solutions. To ensure that knowledge generated by the research in the SR/GL-CRSP is effectively used and communicated, clients were identified early in the planning process and invited to join in the research project. These collaborating institutions have been strategically chosen because they are either key players in the decision making process or important organizations for the dissemination of new technologies. A considerable portion of the knowledge generated by the projects will assist policy makers to make effective choices of alternative scenarios. The incorporation of those policy making institutions into the planning, design and implementation of research projects will enhance the probability that the appropriate knowledge is generated and that it will be used in the policy making process. Their early collaboration in the design and conduct of the research will increase the likelihood of implementation.

The program will manage the knowledge it develops at four levels: global, regional, national and project. New knowledge provides the basis for new perspectives that lead to solutions. In this regard the different scales of the program allow for the formation of powerful contrasts that enhance researchers abilities to understand their systems by providing multiple perspectives. Global comparisons of management of livestock and natural resource issues helps to identify common principles that underlie conflicts and their resolution regardless of culture and ecotype. At the regional level where often-similar environments exist, policy contrasts are very effective between countries. At the national level common

themes can be linked between studies to understand how, for example, human nutrition and risk management alternatives, interact.

Knowledge will be managed as follows. First, at the project level key institutions with technology transfer capacities have been identified and within projects they will have responsibility for knowledge transfer and adoption of policy recommendations with users. In most cases they are in effect the clients originally identified in the assessment process and have been incorporated as collaborators. Second, at the national level, a national coordinator for the project active in the country will be identified and that individual will be responsible for cross linkage of information between projects in the country and identification of key institutions and individuals within the country for dissemination of knowledge. Third, at the regional level knowledge will be managed by a regional coordinating body, such as ASARECA, and linked with the appropriate network within the regional organization. The network would be the key mechanism for reaching the NARS and development institutions. Fourth, the CRSP ME through the PAC and TC will lead the global integration. Depending on funding, the ME will organize meetings at least once a year where the projects will make presentations relevant to the global themes of the program, invite persons outside the program to give additional perspectives on thematic issues and develop grant proposals to enhance promising approaches to the global themes.

The SR/GL-CRSP has insisted on the development of regionally based projects, in part because of the strength of regional organizations in NARS and the emphasis on regional approaches by donor agencies. This means that a strong regional organizational structure already exists within projects. Moreover because of the linkage with new regional organizations such as ASARECA, their networks provide an effective participatory framework for inter-project communication and direct links to NARS. In Central Asia, the CRSP has already established a network for NARS linkages in livestock and with the World Bank position described in this proposal where the first responsibility is the development of regional networks, the CRSP can greatly facilitate this process. At a recent ISNAR Expert Consultation on Agricultural Policy and Management in Central Asia and the Caucasus (June 1998), SR/GL-CRSP Program Director Demment presented a plan for using networks to stimulate NARS communication and organization in the region. The principle agreement resulting from the consultancy was that networks would be formed and used to enhance the NARS. The SR/GL-CRSP will work to assist and support the Central Asia regional

livestock and environment networks and by doing so connect its projects to national and regional efforts in appropriate fields.

In East Africa, ILRI is proposing to donors to fund a network-like association of projects focused on the pastoral systems. In the region there are about seven projects, including the four from the CRSP, two from the ASARECA network and one from another U.S. University, that are working on complementary issues related to pastoral systems. The objective of the association is to identify opportunities for collaboration on specific issues between projects that if supported would give add-on value to the would not be achieved with any project alone. The association would also improve inter-project communication, provide a strong regional research resource in rangeland issues (a weak area for most NARS), and be an opportunity to leverage USAID resources. The proposal is presently being offered to donors.

At all levels communication is the vehicle for knowledge management. Communication will occur through electronic conferences and other Internet connections at the global and regional level along thematic lines, and at the national level between projects. At least once a year the email networks will meet for presentation of results and development of new concepts to improve knowledge management. Regional and country coordination may occur more often in conjunction with other activities of the regional and national organizations. The responsibility for organization of this communication system will be the ME in conjunction with the TC and the national coordinators.

GLOBAL LIVESOCK CRSP YEAR 2000 INTERNATIONAL CONFERENCE
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GLOSSARY

AARNET	Animal Agriculture Research Network
AFRNET	African Feed Resources Network
AID	Agency for International Development, Washington DC, USA
ALRMP	Arid Lands Resource Management Project, World Bank
AMREF	African Medical Research and Education Foundation
ANP	Applied Nutrition Program
AP	Advisory Panel
APEX	Agricultural Policy Environment Extender
ASAL	Arid and Semi-Arid Lands, Netherlands
ASARECA	Association for Strengthening Agricultural Research in East & Central Africa
ASEAN	Association of Southeast Asian Nations
ASF	Animal source foods
AT	Assessment Teams
AWF	African Wildlife Foundation
BASIS CRSP	Broadening Access and Strengthening Input Market Systems Collaborative Research Support Program
BEST	Belize Enterprise for Sustained Technology
BRD-USGS	Biological Resource Division, U.S. Government Service

CARDI	Caribbean Agricultural Research and Development Institute
CATIE	Centro Agronomico Tropical de Investigacion y Ensenaza
CBE	Commercial Bank of Ethiopia
CDC	Center for Conservation Data
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIEC	Centro Interdisciplinario de Estudios Comunitarios (Center for Interdisciplinary Community Studies), Bolivia
CRIAS	Coordinating Research Institute for Animal Science, Indonesia
CRSP	Collaborative Research Support Program
CSU	Colorado State University
DPG	Dual-purpose goat
DPIRP	Drought Preparedness Intervention and Recovery Program
EARO	Ethiopian Agricultural Research Organization
ECF	East Coast Fever
EEP	External Evaluation Panel
EHNRI	Ethiopian Health and Nutrition Research Institute
EML	Explore Mara Ltd.
ESDAR	Agriculture Research and Extension Group, World Bank
EU	Egerton University
EU-TACIS	European Union, Technical Assistance to the Commonwealth of Independent States
FAO	Food and Agriculture Organization, United Nations

FEWS	Famine Early Warning System
FICAH	Food Industry Crusade Against Hunger
FSU	Former Soviet Union
FUNAN	Fundación Antinsana, Ecuador
GATT	General Agreement on Tariffs and Trade
GCC	Gore/Chernomyrdin Commission
GDP	Gross Domestic Product
GHAI	Greater Horn of Africa Initiative
GIEWS	Global Information and Early Warning Systems
GIS	Geographic Information System
GLCI	Grazing Lands Conservation Initiative
GO	Government organization
GPM	Global Problem Model
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
GTZ-MDP	GTZ/Marsabit Development Project
HBCU	Historically Black Colleges and Universities
HPI	Heifer Project International
IAR	Institute of Agricultural Research
IARC	International Agricultural Research Center
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICRAF	International Center for Research in Agroforestry

ICRW	International Center for Research on Women
IDM-MoA	Livestock Development and Marketing Department, Ministry of Agriculture, Kenya
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IGAD	Intergovernmental Agency for Development
IICA	Inter-American Institute for Cooperation on Agriculture
ILCA	International Livestock Center for Africa
ILRI	International Livestock Research Institute
IMAS	Integrated Modeling and Assessment System
IMECBIO	Manantlan Institute of Ecology and Conservation of Biological Diversity
INEFAN	Direccion Nacional de Areas Protegidas y Vida Silvestre
IPB	Bogor Agricultural University, Indonesia
IRA	Institute for Resource Assessment
ISNAR	International Service for National Agricultural Research
ISRN	Indonesian Small Ruminant Network
KARI	Kenya Agricultural Research Institute
KDHS	Kazakhstan Demographic and Health Survey
KDPG	Kenya dual-purpose goat
KEVEVAPI	Kenya Veterinarian Vaccine Production Institute
KRTISB	Kazakh Research and Technological Institute for Sheep Breeding

KWS	Kenya Wildlife Service
LAC	Latin American Countries
LTC	Land Tenure Center
MALDM	Ministry of Agriculture, Livestock Development and Marketing
MCF	Malignant catarrhal fever
ME	Management Entity
MOAF	Ministry of Agriculture and Food
MOU	Memoranda of understanding
NAFTA	North American Free Trade Agreement
NARO	National Agricultural Research Organization
NARS	National Agricultural Research System
NCAA	Ngorongoro Conservation Area Authority
NCRSP	Nutrition CRSP
NDVI	Normalized Difference Vegetation Indices
NGO	Non-governmental organization
NIRS	Near Infrared Reflectance Spectroscopy
NIS	Newly Independent States
NPS	National Park Service
NRCS	Natural Resource Conservation Service
OBAD	Oromia Bureau of Agricultural Development
ODI	Overseas Development Institute
OECD	Organization for Economic Co-operation and Development

OFPEP	On-farm Productivity Enhancement Program
OHLA	Ololepo Hills Landowners Association
OPC	Ovine pulmonary carcinoma
OPP	Outreach Pilot Project
ORP	Outreach Research Project
PAC	Program Administrative Council
PAMM	Program Against Micronutrient Malnutrition
PD	Program Director
PDU-MoA	Pastoral Development Unit, Ministry of Agriculture
PENHA	Pastoral and Environmental Network for the Horn of Africa
PHYGROW	Plant/Hydrology/Yield/Growth Simulation Model
PI	Principal Investigator
PRARI	Promoting Russian Agriculture Through Regional Investment
PVO	Public Volunteer Organization
REDSO	Regional Economic Development Support Office, USAID-Nairobi
RERUMEN	Latin American Network of the Small Ruminant CRSP
RFP	Request for Proposals
RRA	Rapid Rural Appraisal
SAIS	Sociudad Agriocol Interes Social
SALTICK	Semi Arid Lands Training and Livestock Improvement Centres of Kenya
SAM	Structured Analysis Methodology

SCT	Spatial Characterization Tool
SEMARNAP	Secretaria del Medio Ambiente y Recursos Naturales y Pesca
SORDU	Southern Rangelands Development Unit
SPA	Sheep pulmonary adenomatosis
SR/GL-CRSP	Small Ruminant/Global Livestock CRSP
SR-CRSP	Small Ruminant CRSP
SSA	Sub-Saharan Africa
SWRI	Serengeti Wildlife Research Institute
TAES	Texas Agricultural Experiment Station
TAMUS	Texas A&M University System
TANPA	Tanzania National Parks
TC	Technical Committee
TE	Terranueva
TMA	Tanzania Ministry of Agriculture
TT	Technology transfer
UAAS	Uzbekistan Academy of Agricultural Sciences
UCD	University of California, Davis
UCLA	University of California, Los Angeles
UCLAS	University College of Lands and Architectural Studies, University of Dar es Salaam
UDZ	Zoology Department, University of Dar es Salaam
UK	University of Kentucky

UMTWA	Uganda Ministry of Tourism, Wildlife and Antiquities
UN	United Nations
UNAE	University of Nairobi, Department of Agricultural Economics
UNB	University of Nairobi, Department of Botany
UNEP	United Nations Environment Programme
UNESCO	United Nations Educations, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USACP	USA and Canad Program (Heifer Project International)
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USU	Utah State University
UWI	University of West Indies
UW-Madison	University of Wisconsin-Madison
VOCA	Volunteers in Overseas Cooperative Assistance
WANA	West Asia and North Africa
WC	Williams College
WI	Winrock International
WRI	World Research Institute
WOCCU	World Council of Credit Unions

