

**COMMUNITY PLANNING FOR SUSTAINABLE LIVESTOCK-BASED FORESTED  
ECOSYSTEMS IN LATIN AMERICA  
(PROJECT PLAN - PLANIFICACION LOCAL AGROPECUARIA  
Y DE LA NATURALEZA)**

**NARRATIVE SUMMARY**

This project works with communities in forested mountainous areas of Latin America to improve the quality of life for small landholders through land use and livestock management that is sustainable at the family and community level and sustainable for the environment at the level of the watershed. The project work is organized around four principal objectives: 1) identify the potentials and limitations for community sustainable management of natural resources and livestock, and improved quality of life; 2) evaluate current practices of livestock and natural resource management and experiment with alternatives; 3) generate a participatory process for planning, implementing, and monitoring current and alternative practices; and 4) establish a long-term, ongoing community planning process for natural resource and livestock management.

An important secondary goal is the study of the process of achieving community-based sustainable development including 1) monitoring the project activities and 2) the development of an integrated, participatory, process-oriented learning approach.

**RESEARCH**

**Problem Model and Approach.** The goal of our project is to determine how livestock, agriculture, and natural resource uses can be incorporated into the environment in a manner

that is ecologically sustainable and that will improve the livelihood of local residents and to achieve this goal through working with and empowering local communities. The area focus of our project is the interface between agricultural and forested ecosystems in critical mountainous ecosystems in Latin America. Livestock, especially cattle, dominate these threatened and degraded landscapes, leading to two questions: 1) what role can and does livestock play in the livelihood of the rural communities of our study sites? 2) how can livestock be integrated into these forest ecosystems in a manner that is ecologically sustainable? Our increased understanding of these regions and their people has reinforced the need to take an holistic approach at the level of the community and the watershed. To find viable answers to these questions, it is crucial to understand the physical, ecological, social, cultural, and economic context.

The Problem Model defines a process for describing, studying, planning, implementing, and monitoring the integration of livestock, agriculture, and natural resources uses into natural forest ecosystems to achieve sustainable production. This process is organized around four steps: 1) identify the potentials and limitations within the community for sustainable management of natural resources and livestock, and improvement of quality of life; 2) evaluate current practices of livestock and natural

resource management and experiment with alternatives; 3) generate a participatory process for planning, implementing, and monitoring current and alternative practices, and 4) establish a long-term, on-going, community planning process for natural resource and livestock management. The successes we have achieved to date strongly reinforce the value of a participatory, process-oriented learning approach. We are continuing in our goal to assemble a “tool box” of strategies, tools, and methods that can be applied effectively and appropriately to rural communities throughout Latin America.

**Changes to the research plan.** The following initiatives developed in year 5 resulted in new perspectives that have influenced the more focused activities of year 6 and provided the bases for several new directions extending the application of the project, expressed in our proposal for a second phase.

1. Intensified farmer/investigator joint experimentation with pasture improvement.
2. Increased focus on wildlife/productive system conflicts.
3. Increased participation of host-country community representatives in our annual planning meetings.
4. Increased focus on community group organizations (women’s groups and producer groups).
5. Increased collaboration with governmental institutions and fostering of stronger linkages between local government and community organizations.
6. A new initiative to develop a systematic appraisal of the land tenure situation in all three host-countries.
7. Increased focus on policy and its influence on local land use and management.

**Progress.** Greater integration of Project research activities was achieved by reassessing our 45 past activities in 6 categories and reassembling key functional elements from them into a sequence of 9 activities following an overarching activity, emphasizing our goal to develop a model process for guiding community-based, sustainable agricultural development.

### **Activity One: Creating a Process of Community-based Participatory Agricultural Development**

The most important expected outcome of Project PLAN is the creation of a process or model of community-based participatory agricultural development with a “tool kit” of approaches, methods, and guidelines for use by development agents and/or communities. In our previous workplans, the creation of this process was assumed as an outcome of the other activities. For year 6, we developed this Activity 1 to focus specific work aimed at the development of the process itself. We are using this activity retroactively to allow space to discuss advances related to this key work.

The project “development process” model has gained new clarity as work on diverse aspects of the farm communities—social dynamics of extensive livestock systems, diversification of household economics, land tenure and natural resource conflict issues, and family food insecurity—has provided greater understanding of interactions within these farming systems.

A successful evaluation of Project PLAN through an EEP site visit to Ecuador facilitated a critical examination of our goals, assumptions, and strategies; validating our participatory and holistic approaches; recognizing the power of our team as a learning organization and the importance of

progress already achieved; emphasizing our focus on community-based sustainable development and action research; and identifying key aspects of the project that need systematic documentation of advances achieved and a more focused research plan to consolidate the various activities to strengthen community empowerment.

*Objective 1.1: Conceptual analysis of the fundamental differences between the approaches to solve divergent versus convergent problems and the implications with regard to the appropriate role for external actors, institutions, and project development.*

Two diagrams created for the Year 4 annual report, one showing the bio-physical problems for sustainable development and the other showing the factors influencing household security, served to sharpen the comparison between the biological priorities of sustainable development relative to the problems that influence the priorities of the farm households in these landscapes. The second diagram served to show the important linkages between our activities on agricultural productions systems (Activities 2, 3, 4, and 5) and those centered on natural resource/tenure conflict (Activity 6), household food insecurity (Activity 7), community organization and social capital (Activity 9), and interactions of communities with local government and policies (Activity 10). This contrast between local and scientific priorities for sustainability and illustration of these linkages was a first step to show the necessity of the holistic approach—long term solutions at the level of the community were going to require attention to the interaction of such diverse factors as land tenure, food insecurity and social capital in addition to improvement in agricultural practices.

The conceptual contrast between convergent and divergent problems (article in *Ruminations*, Winter 2002) served to direct our focus to the critical importance of community organization and human and social capital. This is one of several concepts that we are using to create the theoretical basis for the “process model of development.”

For Project PLAN, the recent EEP site review in Ecuador served us well to reflect on our “process of development” in relation to our application of our development/research activities. The implications of this exercise can be summarized in two main points; first, although the scale we have identified for effective environmental planning remains the watershed, the main strategy of the project for achieving sustainable agricultural development is focused on the local communities. It is through the actions of individual farmers and their interactions as “communities” that the practices of sustainable agriculture will occur.

Secondly, the effectiveness of the approaches and methods of our “process of development” need not be demonstrated so much in changes and outcomes that are occurring, but more in the documentation of the process itself—the changes in perception and learning that have occurred and are occurring as a result of the processes that constitute our model. Both of these points lead to an increased emphasis on participatory action research with local farmers, households, and communities.

Five areas of work that integrate different activities and different aspects of sustainability have served as entry points for participatory action research: farm management plans (Ecuador, abbreviated as E), household livelihood diversification (Mexico, abbreviated as M), farmer experimentation (Bolivia, abbreviated as B, and E), producers’

and women's groups (M,E,B), and food security (M,E,B). While these areas of work implicitly link different aspects of sustainability and local priorities, it is the interactive, participatory, collaborative nature of our approach in these areas that has created new understanding and insight into creating favorable situations for better livestock production, improved livelihoods, and sustainability.

*Objective 1.2: Assessing and documenting the nature and basis of farmer experimentation.*

Our newer focus on farmer experimentation has evoked a complementary diversity of conceptual thinking about the dimensions of farmer experimentation. This area of inquiry has opened a fascinating and productive mechanism through which to understand farm household priorities, to understand the strengths and weaknesses of the methods used by farmers to experiment and assess the results, and to explore the different levels of participation. In our Annual Planning Workshop, we began to develop instruments that would allow us to design a systematic research plan and methodology in all three countries. Working with farmers in experiments has developed learning processes and participatory action research initiatives oriented to the interests and needs of these farm communities.

*Objective 1.3: Development of a strategy for the use and dissemination of planning information by appropriate user groups.*

*Objective 1.4: Strengthening and training host-country collaborators, institutions, and future researchers and practitioners.*

One of the strengths and difficulties of our project is the difference in orientation and focus of academic researchers compared with professional NGO practitioners. Conservation and development practitioners by necessity spend more time “doing” rather than studying or reflecting from a scientific perspective. The insights and lessons they gain are rarely written and shared. As a result, development insights are poorly spread among those interested and the scientific conceptual bases of development approaches are not informed by the empirical findings of those involved in the application and working of those approaches.

The new GL-CRSP Research Brief format is a valuable tool we have adapted as an effective mechanism for dissemination of results. Although we have produced over sixty documents in Spanish from the work of the three country teams, transforming these into appropriate publications for dissemination is a time-consuming and expensive process. Adopting the concept of the “research brief” in March, we initiated the preparation of short, working papers, which we initially called Project PLAN Research Reports. In the first ten weeks of this initiative, our host-country teams produced 30 working papers. The short size and tight focus of these working papers made the process of preparing them for publication as GL-CRSP Research Briefs and/or for publication in professional journals in other appropriate sites rapid.

### **Activity Two: Changing land use/land cover at the scale of the watershed**

*Objective 2.1: Completed set of land use/land cover maps and identified critical areas for protection of watershed catchment areas, riparian zones, and fragile soils.*

We now have a full set of thematic maps for each of our study areas, which will be valuable for informing local and regional planning. These maps were largely produced by PLAN researchers using satellite images and/or aerial photographs. In some cases, maps were produced using local ideas about potential land use. These maps were used to identify protection areas and helped determine the criteria applied by local land managers (see Cardenas and Martínez, 2001). These maps will continue to be a valuable resource to inform and guide planning activities on multiple scales.

*Objective 2.2: Completed land use/land cover change analyses to assess the nature of changes in vegetation and land uses in the PLAN study areas.*

These studies of land change are valuable for providing a historical perspective on changes in land use within these regions. This information will allow analyses and assessment of the possible factors, events, and policies that have influenced these changes. These studies, therefore, provide an important background for informing current management, planning, and policy activities. Descriptive studies of land use/land cover change have already been completed for four sites: 1) the Tomatirenda and 2) the Rio La Sal watersheds (B) for 1967 and 1997 (Espinoza and Ruiz, AGROSIG); 3) for the Ejido Zenzontla (M) for 1971, 1993, and 2000 (Cardenas); and 4) the Cosanga watershed (E) for 1997 and 2000 (Penafiel, The Alianza Jatun Sacha/CDC). Their preliminary findings are in PLAN working papers. The analyses of causal factors will follow with two dissertation studies in progress (Cardenas, M; Espinoza, B).

*Objective 2.3: Analysis of impact of livestock activity on native vegetation and regeneration.*

The impact of livestock on different forest vegetation types was studied within the Sierra de Manantlán Biosphere Reserve (M) (Sánchez-Velásquez et al., 2000 and in press). In Bolivia, a recent extensive auto-diagnostic of livestock production and land use potential was carried out across the Guarani zones to provide a basis for assessing the status and potential for livestock production within the area (Lozano et al., analyses in progress). Impact on vegetation by livestock activity and analysis of vegetation change has also been studied through the use of permanent paired plots—one fenced plot excluding livestock foraging paired with a second permanently marked plot 5 meters or more away from the first, in which continued livestock foraging is permitted. These paired plots were duplicated in 5 different vegetation types in both Mexico (10 total plot pairs), and at each study area in Bolivia (20 total plot pairs). Detailed systematic vegetation measurements have been collected annually at all plots. Analyses of these data are expected to be completed in Year 6.

*Objective 2.4: Analyses/studies documenting the current status and trends in water management issues within the study area watersheds.*

PLAN researchers in Mexico (Martínez, working paper; Mercado Silva, M.S. thesis, 2001, and working paper) have been involved in larger scale studies of the Rio Ayuquila watershed, which includes the main PLAN study areas. Their studies provide a clearer assessment of water contamination problems in the regions and their impact on the

livelihoods of farm communities along this river. These studies serve to show how these farm communities depend on products and services of the watersheds in which they live.

*Objective 2.5: Promotion of restoration of watershed protection forests.*

This objective includes experiments with farmers to allow regeneration of forest vegetation in pastures and enrichment of native timber species to provide future added value of selective timber extraction. This process is coupled with the development of community tree nurseries to provide a source of seedlings for this activity, as well as agro-forestry activities (see Act. 5 and Sánchez-Velásquez 2000). Part of the work of PLAN with the community tree nurseries is the joint identification of native species with high potential value, as well as developing germination and silviculture techniques for species without known nursery propagation procedures, such as with the valuable keystone riparian mojote tree (*Brosimum alicastrum*) in Mexico (Hernández-Vargas, 2001).

### **Activity Three: Understanding the Dynamics of Extensive Livestock Production**

*Objective 3.1: Description and analysis of extensive livestock production systems.*

Our principal livestock focus is on the little-studied extensive cattle production systems in the mountain-forested ecosystems of Mexico and South America. This objective has led to studies of cattle seasonal migration movements between pasture/crops and forest (B, M), and transhumance patterns and their articulation with social systems (B). Seasonal shifts in foraging areas form part of the extensive and semi-

extensive cattle production systems in all four PLAN study sites. We are discovering interesting ecological and social patterns in these systems, which can be viewed as complex syndromes of inter-related sets of consequences.

### **Extensive Livestock Production in Latin America: A Syndrome of Consequences and Options.**

Extensive livestock production systems (ELS) are characterized by the large scale over which the animals are deployed and by the apparent low level of inputs invested in the production. In Latin America, extensive cattle systems have been targeted as a primary cause of deforestation as well as a cause of increased social and economic inequality. The impact of cattle on natural ecosystems is further compounded by the fact that, in the Americas, cattle are exotic species and are often partially supported by the widespread planting of exotic and invasive grasses such as kikuyu, which have altered natural ecosystems over large areas of South America. If cattle are incompatible with natural ecosystems, then what are the options to achieve sustainable production? As a development AND research project, Project PLAN began by re-examining this story to see if it is true. An integrated, collaborative, and community participatory study of the nature and dynamics of four different ELSs in Bolivia, Ecuador, and Mexico reveals much greater complexity and multiple coherent stories. Here we present some of the perspectives we have learned.

**Variation in “extensiveness.”** Two initial perspectives of ELSs are important to consider: 1) ELSs have been developed in traditional form and more recent variants in a wide range of environments in many areas of the world, showing a wide range of variation in components and dynamics. In Latin

America, ELSs are often associated with shifting (slash & burn) agriculture and may include the practice of inter-planting crops with grasses to increase the production of livestock forage. The forests themselves are often included as a component of the foraging systems, particularly so where the climates show strong seasonality in rainfall. 2) The extensiveness or intensiveness of livestock production systems is a relative distinction. Not only do systems labeled as “extensive” vary in their degree of intensification, but more significantly, they vary in the degree of intensification among the different components of these systems.

The type and degree of intensification or extensiveness of a production system can be seen as an outcome of a complex interaction between a series of biophysical and socio-cultural-economic factors. Within a given landscape, size of animal, coupled with its needs and risks, is often manifested as an overlapping series of concentric areas in which small animals are kept close to the homestead, medium-sized animals maintained within the daily domain of control from the homestead (typically on the property of the farm), and larger animals arrayed over a much larger area. This series suggests that intensification of production might be expected to be greater for smaller animals.

For farm communities dominated by small land holders, the typical situation in PLAN study sites, the radius of areas used by cattle may frequently be greater than the area owned or controlled by individual farmers as illustrated for the small Rio La Sal watershed in Bolivia. With respect to spatial patterns, in Mexico and Bolivia, the land controlled by any given household is not likely to contain all the areas needed in different systems; therefore, cattle production requires social agreements among neighboring households through land

use rentals (frequently used in the PLAN communities in Mexico) or reciprocal land access agreements (used in some farms in La Cueva, Bolivia). The patterns demonstrate strong links to watershed-scale land use patterns and to land tenure and conflicts (also see findings of land use access study under Activity 6, below). The problem of having access to appropriate land (sufficient in quality and extent) is further increased in complexity in seasonal environments, such as occurs in our sites in Bolivia and Mexico. Under these conditions, individual farmers with cattle must negotiate arrangements with neighboring landowners to obtain access to type and extent of land needed to maintain their herds. Successful production for these farmers requires managing complex social interrelations complicated by environmental variability in time and space.

A central feature of the cattle ELSs is the extreme variation of the availability of forage in time and space. In west central Mexico (M) and in southern Bolivia (B), strong seasonality alters the temporal and spatial availability and quality of sources of forage. In the Zenzontla Ejido (M) and in the Tomitarena watershed (B), cattle spend the rainy season browsing in the forest, while pasture and crop forage sources are growing. Cattle are moved into forest to feed during the wet season while pasture and crops are growing outside the forest; then, at the end of the rainy season after the corn has been harvested, the cattle are moved out of the forest to feed in mature pastures and on stover in harvested corn fields (Louette et al., 2002). The change over periods between forests and croplands may often be critical due to variability in the length and intensity of the rains. Poor quality and availability of forage at the end the dry season may result in loss of animals that are already weak or stressed. A body condition sample

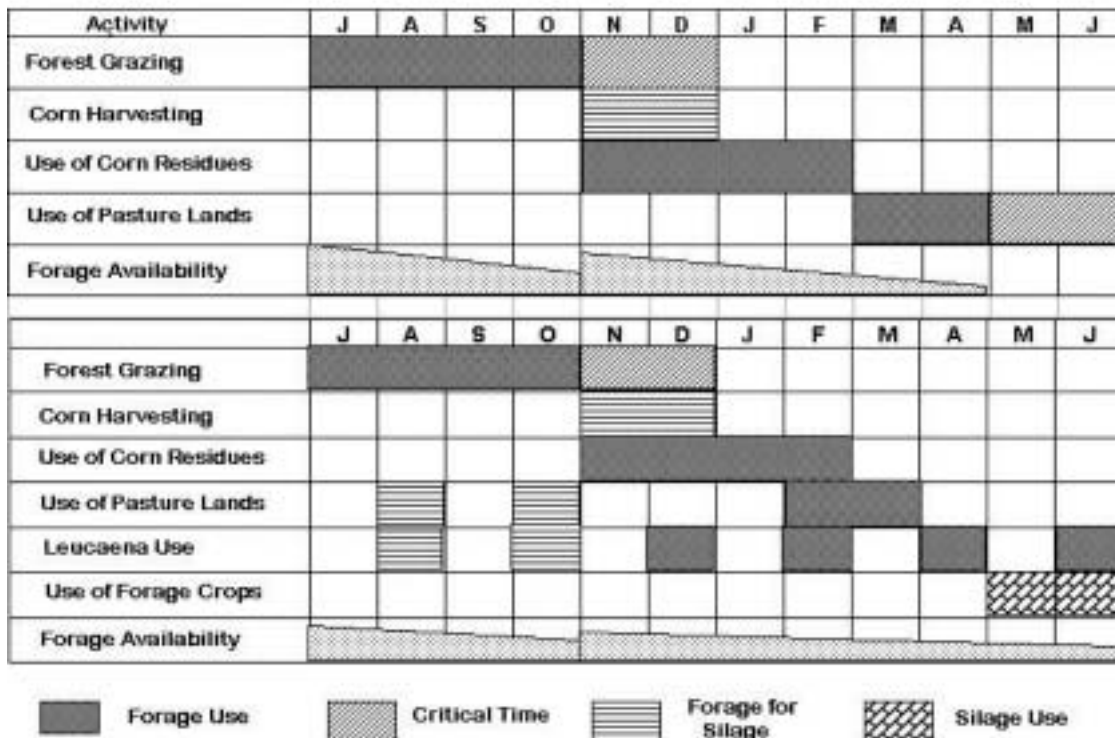
from herds near Timboy, Bolivia at the end of an extended dry season showed one fifth of the cows to have a score of 0.75 out a scale of 1 to 5. Farmers use some management practices to compensate for difficult times by selectively moving particular cattle (pregnant or weak cows) to better sites; however, delays in the start of rains and insufficient rainfall frequently result in critical conditions for livestock survival at the changeover periods due to extreme shortages of livestock food sources.

PLAN has been working with these farming communities to identify potential activities to deal with some of the livestock production problems associated with these extensive systems (Martínez et al, working paper, in press). Various options to improve these Extensive Livestock Production Systems

are being studied through participatory action research with individual farmers, local producers' associations, and farming communities. The chart in Fig. 1 provides a comparison between (A) the current ELS being followed in Zenzontla, Mexico, and (B) a proposed system to improve the availability of forage throughout the year. The proposed system includes several integrated components: agro-forestry, new forage crops, and the local adoption of forage storage practices (silage).

While cattle at the PLAN Mexican site and PLAN Bolivian Timboy site spend the rainy season browsing in the forest while pasture and crop forage sources are growing, in the La Cueva site in Bolivia (B), cattle show the reverse pattern, spending the rainy season in pastures and moving to the forest during the

Figure 1 - Current forage management (above) and proposed forage management (below)



dry season (Fig 2). The differences in these patterns are related to forage availability inside and outside the forests as well as to animal health factors. The different patterns afford different advantages as well as consequences. We are continuing to investigate options to

improve the cattle production systems at all these sites, including options dealing with animal breeding and health. All the options being investigated, however, must be considered within the entire environmental AND socio-cultural-economic system of the locality.

Figure 2 - Typical Seasonal Migration Shift of Cattle in Mexico and Bolivia

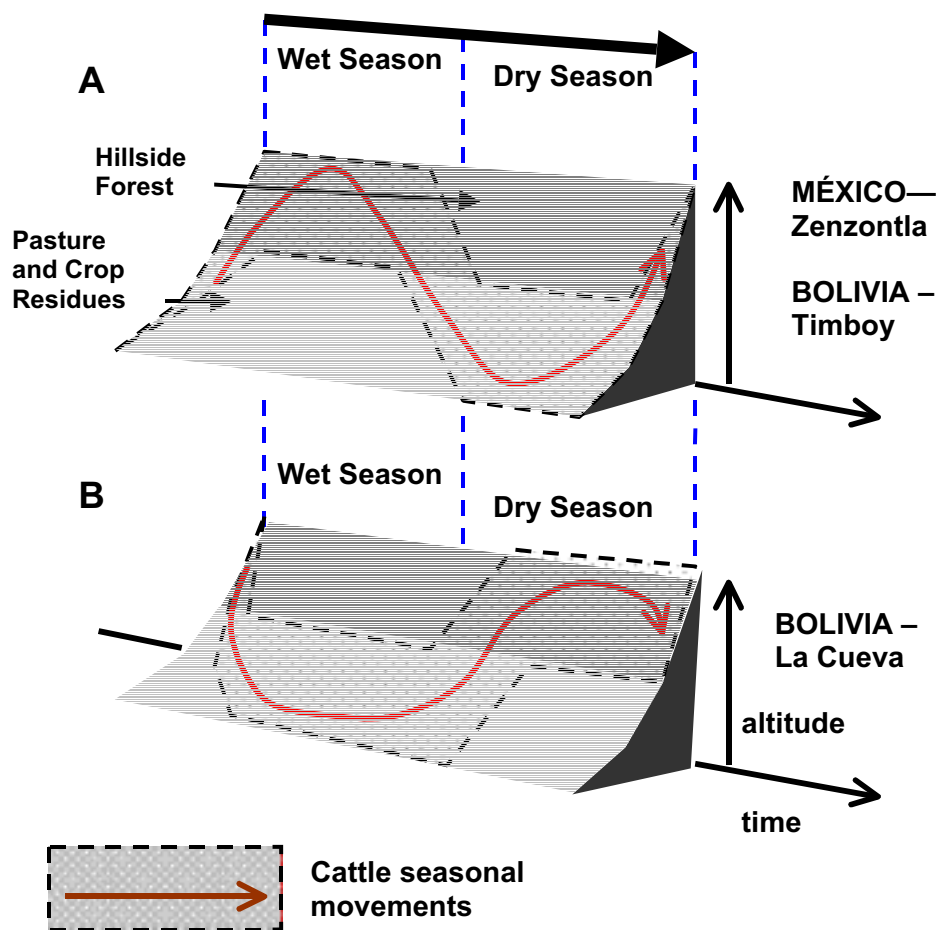


Figure 2

**A— Typical Seasonal Migration Shift of Cattle:  
Wet Season Feeding in Forest  
Dry Season Feeding in Pastures and Crop Residues**

**B—Reverse Pattern Followed by Cattle in La Cueva:  
Wet Season Feeding in Pastures  
Dry Season Feeding in Forest**

**Livestock production options at larger scales: transhumance system.** Studies in progress in Bolivia have compared the linkage of these large animal production systems with the social system and constraints of resource-poor communities of small landholders (Vacaflores, Ruminations, Summer 2002; working paper); these studies provide a broader picture of the potential driving forces of these systems, which will provide a useful framework within which to seek solutions to some of the key limitations of these production systems. In addition, Vacaflores' study of two transhumance systems (long-distance, cyclic seasonal cattle migration systems) with leveraged funds has opened up an important new perspective: initial field observations of these systems suggest that they may be ecologically more sustainable than the less extensive production systems or the more intensive "modern" production systems (Vacaflores et al., in press). At the same time, Vacaflores' studies draw attention to potential threats to the social/political stability of these transhumance systems due to lack of understanding and misconceptions. Follow-up studies will involve links to other activities including Activities 4, 6, 7, and 10.

*Objective 3.2: Completed studies documenting patterns of movement and feeding of cattle in forest. (M).*

Extensive cattle production systems in tropical deciduous forests of western Mexico are limited by forage quality and availability, particularly in dry season. At the start of the rainy season, cattle are moved into forests where they feed for six months. Cattle foraging behavior in tropical deciduous forest was studied to determine diet selection and use of forest type and slope (Esparza et al., two working papers; Esparza, Thesis, 2002). At the

beginning of the wet season, cattle were primarily browsers with 80% of their feeding on trees, shrubs, and vines. During most of the season, diet in forested areas consisted of herbs (48%), trees, shrubs, and vines (41%), and grasses (11%). Diet in disturbed forest areas differed markedly: grasses (55%), herbs (29%) and trees, shrubs, and vines (16%). Cattle were observed feeding on 145 plant species, nearly all of which contributed <1% individually to cattle diets, indicating poor availability of quality forage. This is a much higher number of species eaten than estimated by agronomists, and includes over one-third of the plant species recorded in this area. Greater total biomass was consumed in semi-open forest. Further studies could include nutritional analysis of preferred plants and practices to improve forage of disturbed areas, improving cattle performance, and reducing damage to the native forest.

*Objective 3.3: Completed a study documenting incidence of disease and parasites in extensive livestock production systems (B).*

While ESLs have the advantage of requiring little material input and labor from the farmers, the disadvantages relate to the relatively poor quality of forage available (as indicated by the study above), the lack of control over animal breeding, and conditions that result in high levels and spread of parasite infestations and high vulnerability to and propensity for the spread of infectious diseases and epidemics. Pigs in these extensive systems are exposed to and frequently contract a variety of diseases, with parasitic diseases among the most important. The Tomitarena watershed within the Guarani Zone 1 is denominated as a Red Zone due to the purported high frequency of porcine tapeworms

(*Cisticercosis*) in marketed pigs coming from the zone. A macroscopic examination of muscle samples from 469 slaughtered pigs from the Municipal slaughterhouse of Tarija found an incidence of 28% among pigs from the Tomitarendá zone, confirming its Red Zone status. This contrasted strongly to the reported incidence levels of less than 3% among pigs in the Municipal slaughterhouse in Santa Cruz.

The high incidences of contagious diseases and parasitic infestations reduce health and production levels. In the case of porcine tapeworms, due to the risk to humans of contaminated meat accompanied by the confiscation of slaughtered carcasses, the economic losses are serious but difficult to confirm. The confirmation of the high incidence of tapeworms among pigs in the Tomitarendá region emphasizes the need for technical and economic assistance, as well as education campaigns aimed at improving the infrastructure and management practices needed to improve sanitary conditions in the area to reduce the prevalence and infestation risk of this parasite in the region (Paita and Corzo, working paper; Corzo, Licenciatura thesis).

*Objective 3.4: Trial application and use of cattle body scoring to make statistical comparisons of cattle condition under different biophysical regimes and management practices.*

Initial trials of body scoring with photography proved useful when the cattle were photographed in good light conditions showing the right-side profile. The diversity of conformation found among the mixed “criollo” cattle of these zones was easier to take into account through side profile views, in contrast to the standard rear views used for uniform breeds. Feasibility problems with respect to the large number of photographs that

would be needed for appropriate sampling were solved through the use of digital cameras. Field-testing of digital cameras in Bolivia resulted in the selection of the Olympus C2100 with a 10X optical zoom. Six of these cameras were subsequently purchased with special UW-Madison equipment funds and deployed among the three country teams.

#### **Activity Four: Optimizing the Interactions between Biodiversity and Agro-Ecosystems: Conflicts and Uses of Animal and Plant Species.**

*Objective 4.1: Completed studies on the conflicts between key wildlife species and livestock/agricultural production.*

**Vampire bats.** Completed analysis on the roles and campesino perspectives of vampire bats in farm communities in Mexico (Iniguez and Esparza, data collection and analyses completed, working paper in progress). Vampire bats (*Desmodus rotundus*) drink blood from cattle leaving open wounds that make the cattle more susceptible to parasites and the transmission of diseases such as rabies. Two-thirds of 87 farmers interviewed reported that their cattle had been attacked by vampire bats and nearly 90% perceived vampire bats as a problem. However, among those whose herds were attacked, 69% had taken no actions to prevent further attacks and 60% did not know of any actions to take to control the vampires. At the same time, few were aware that most bats did not drink blood and were beneficial for the control of mosquitoes, as pollinators, and as seed dispersers. This study emphasizes the importance of education/extension programs in increasing the awareness of means to control the vampire bat problem as well as increasing understanding of the role of bats in the productive system.

**Parrots & oropendulas.** Completed preliminary field study of impact of birds on maize cultivation in the Rio La Sal watershed (B). At both sites in Bolivia, birds are cited by local farmers as serious pests to their cultivated crops, particularly maize and citric fruits. The birds most frequently mentioned as problems are oropendulas and several parakeet and parrot species. We are working with farmers to obtain a quantitative assessment of the nature and magnitude of the damage caused by different bird species as the first step toward seeking solutions to this problem (Jurado, Licenciada thesis in progress).

**Spectacled bears.** Completed study on the interactions of the endangered spectacled bear with cattle and maize, as well as management recommendations to reduce depredation in Ecuador (Galasso, M.S. thesis, working paper, manuscript submitted for publication to Oryx; Castellanos, working paper). Spectacled bears (*Tremarctos ornatus*) leave protected cloud forests and enter adjacent farms to feed on cultivated crops or prey on livestock. The consequences of this behavior can be severe for both farmers and bears, as farmers lose valuable livestock and may kill bears indiscriminately to avoid further losses. Economic impact of livestock attacks and crop damage attributed to the spectacled bear were investigated on farms adjacent to the Antisana Ecological Reserve in northeastern Ecuador. Crop raiding was monitored on eight farms in two communities. All reported attacks on cattle were investigated through interviews with the nine affected cattle owners or managers and attack-site visitations. Crop damage by bears appeared to be negligible, but 31 cattle were reportedly attacked in two communities over a 13-month period. Affected farmers lost livestock valued

between US \$200 - 2,100 (average US \$756). Local residents recalled no previous attacks by bears on cattle. Eleven bears were reportedly killed in the study area during the same 13-month period. To determine factors responsible for the cattle attacks, we compared landscape features and farm-level variables for 9 affected versus 13 unaffected farms. Analysis revealed that farmers who pastured cattle adjacent to the forest edge as well as farmers who did not bury or remove cattle carcasses from pastures were significantly more affected. The presence of livestock carcasses may draw bears to pastures where they first consume livestock as carrion and subsequently change their behavior to prey on live cattle.

*Objective 4.2: Regional analysis of distribution by habitat of endemic and endangered birds and the impact on avian biodiversity of livestock-related changes in land cover/land use (M).*

Earlier regional analyses in the S. Jalisco (M) showed many bird species endemic to the Mexican region occur primarily in the tropical deciduous forests that are most impacted by conversion to agriculture and by extensive livestock production (Contreras, M.S. thesis 1999; Cardenas and Contreras, working paper). More intensive studies in the Zenzontla Ejido show that the endemic species of most concern are centered in riparian forest remnants, locally called *mojoter* due to the dominance of the evergreen tree known as the *mojote* (*Brosimum alicastrum*) (Hernandez, M.S. thesis, 2002; Contreras et al., working paper in progress). This association of bird conservation concerns with the habitats created by the *mojote* tree provides a special opportunity in which several conservation interests converge. These *mojoter* are important sites for watershed protection (see

focus on regeneration research, Activity 2, Objective 2.5) and the mojote itself is a valuable resource providing several recognized products for human and livestock use (Activities 4, 8) (Moermond and Contreras et al., working paper in progress).

*Objective 4.3: Completed analysis of the extent and nature of fishing activities for consumption or income within the Ayuquila River watershed (M).*

Fishing is a frequent activity by farm household families of communities along the Ayuquila river. A few fisherman sell their catch in nearby markets; this is particularly so for those who trapped crayfish species, which are endemic to the region and highly prized as food. Most fish caught are for consumption by the household and constitute an important source of protein for these families, who otherwise often show diets deficient in animal protein, particularly for children (see Activity 7). Perceptions of local fisherman, obtained through extensive interviews across several farm communities, show fishing to be also a valued source of recreation and a positive social mechanism. The farm fisherman viewed fishing overall as contributing significantly to their quality of life; most also showed strong concern over recent problems of contamination of the river (Mercado-Silva, M.S. thesis, working paper on fish as bio-indicators of water quality completed, working paper in progress on the importance of fishing for local farm communities).

*Objective 4.4: Establish a database of the use and potential of the natural vegetation for local use (food, forage, herbal medicine, fiber, construction) (E, M, B).*

Databases have been established in Bolivia (Guarani area, CER-DET: Cuba, Castro, and others), Ecuador (Fuentes, Alianza Jatun Sacha/CDC), and Mexico (IMECBIO, Cuevas, working paper, and Moreno, working paper). These databases show the use and potential for non-timber forest products in these areas. These studies are documenting the importance of native forests to the livelihoods of farm households in these communities. Although the economic values of many of these uses are difficult to determine and have been largely undervalued, some farm household extraction activities contribute significantly to local livelihoods (Activity 8—Morales, Licenciada thesis 2001; Eakright, M.S. thesis 2002).

*Objective 4.5: Promotion of environmental education to enhance awareness and understanding of the nature of the value and conservation of natural resources.*

**Campesino perceptions of environmental degradation.** Understanding the perceptions of local people about their natural resources and environmental problems is necessary to inform planning and education activities. Two recent preliminary studies in La Cueva (B: Flores) and in a community in the Sierra de Manantlán Biosphere Reserve (M: Maria Montero Castellana, a UDG-CUCSUR Licenciada student of Gerritson) will be used to develop a systematic focused study of local perception in the future.

**Use of birds as focus for environmental awareness.** Completed bird species list and inventory/sampling analysis for both sites in Bolivia, with brochures prepared for public and educational use. Preliminary inventory lists provided the basis for environmental educational activities focused on birds using

local brochures, coloring books, and posters; public events, field workshops for children—Flores (B); Contreras (M).

**Development of environmental and sustainable development curriculum in collaboration with the regional Colegio Agroforestal.** This secondary school is a unique training center for the Quijos region of Ecuador. The assistance of Project PLAN was sought by the school to assist in the development of a new sustainable development training option for future farm managers, foresters, and policy makers in this zone (PLAN-Ecuador: Mosquera, Murillo, Hernández, Molina).

**Activity Five: Experimenting with forages, crops, and agricultural management practices to improve production and sustainability of agro-ecosystems.**

*Objective 5.1: Completed assessment of the nature and variety of farmer-identified experiments (B).*

A preliminary assessment of farmer-initiated experimentation, initiated by Molina and Vacaflores, was completed for the La Cueva site (B) by Molina, opening a new arena for understanding farmer interests and targeting appropriate technical assistance (Molina and Rosemeyer, working paper; Molina, working paper in progress). Rosemeyer has followed this study with the development of a standardized interviewing instrument to facilitate a systematic study of farmer experimentation on all sites, which will provide an excellent basis for action research initiatives.

*Objective 5.2: Assessment of forage sources and availability to identify and design specific activities to increase forage quality and quantity to improve livestock production.*

Pasture improvement through the incorporation of native forage species. Native species that invade planted pastures had been seen as weeds to be eliminated. Action research led by a PLAN researcher (Calispa) working with local farmers led to an initial study of the potential value of more than 20 native forages to enhance the nutrient balance in the cattle's diets and to increase soil protection (species resistant to trampling) and sustainability of the pasture "community" (greater diversity, less vulnerable to pests (Calispa et al., working paper).

Improvement of soil fertility and forage availability in cultivated maize fields (M) through agro-forestry experiments with the introduction of leguminous trees (*Leucaena leucocephala* and *L. esculenta*) along contour erosion barriers within fields (Martínez et al., working paper, in press; Adame, et al., working paper).

Creation of improved forage in degraded dry vegetation through silvo-pastoral experiments with the introduction of forage grasses under native leguminous tree cover (B: Guarani communities) (Lozano and others; initial implementation of trial plots in progress).

Pasture improvement for dairy production with experiments involving a) construction of pasture drainage ditches to improve saturated soils, b) enhancing a leguminous forage (*Lotus uliginosus*), and c) rotational grazing through the use of electrical fencing. This experiment on one farm in Ecuador has now been followed through three cycles of rotation. The improvements have shown a significant increase in milk production, which has generated

considerable interest among the small-scale dairy producers in the community (Milofsky et al., working paper; Molina and Mosquera, working paper). A summary of this expert/farmer collaborative experiment follows.

**Farmer experimentation with pasture improvement for dairy cows (Ecuador).** The regional approach to pasture establishment in the mountain dairy production of eastern Ecuador (Baeza region, including PLAN sites in the Las Palmas community) requires sowing forage species on 5 to 15 hectare parcels of land cleared from forest. Kikuyu grass is widely accepted because of its rapid rate of establishment, large biomass production, and high nutrient content in younger growth. Today, farm size in the Las Palmas region averages 57 ha, with 31 ha in pastures/fields and 26 ha in unconverted forest. The amount of forested land accessible to farmers dwindles with each year's tree harvest and remaining forested land, due to slope and location, is marginal for agricultural production purposes. Thus, farmers are increasingly forced to seek more sustainable alternatives to their conventional production systems.

One promising alternative to conventional kikuyu grass pastures is the incorporation of legumes (nitrogen fixing plants) into the forage stand. Legumes benefit pasture systems by fixing symbiotic nitrogen, which is eventually cycled back to the soil and taken up by forage plants, both legumes and non-legumes, resulting in more vigorous pastures. Pasture legumes also serve as a direct source of protein and energy for livestock. Farmers are recognizing that lotus is useful in low-input humid-highland pasture systems because of its resilience to low fertility acidic soils, its remarkable tolerance to long-term flooding, and its compatibility with kikuyu grass, which tends to dominate pasture systems in well-

drained soils of moderate or greater fertility. Lotus is able to establish and thrive in places where other legumes would not, such as degraded hillsides and areas with standing water. Lotus is useful for restoration of severely eroded hillsides because its dense vegetative cover intercepts rain droplets, thus decreasing the velocity and carrying capacity of surface flow. Lotus also contains condensed tannins; tannins render the legume bloat safe for ruminants by decreasing the rate of plant protein solubilization in the rumen. Thus, farmers can feed cattle large quantities of lotus with no concern of bloat.

Although the benefits of lotus are clear to many of the farmers who have worked with the legume, the extent of the benefits had not been measured. In order to better promote legume use throughout the community, a leading farmer approached project PLAN with a desire to compare milk yield on rotated pastures with and without lotus. Although milk yield is only one benefit of lotus incorporation, it reflects pasture quality (digestibility and protein content) and is more easily measured in a field setting than other benefits, such as improved soil fertility and erosion control.

Findings are based on data collected from three grazing rotations that took place between November 2001 and July 2002. Production on thirteen different pastures was analyzed, yet each rotation included a different selection of paddocks. Some of the pastures contained only kikuyu grass and naturalized species, others included up to 40% lotus. Mean forage availability for pastures was 56 kg/cow/day, with a maximum daily intake of approximately 21 kg/cow/day, or 38% of the total available pasture. Paddocks were divided into treatments based on percent lotus of total vegetation: 1) greater than 15% lotus; 2) 10-15% lotus; and 3) 0 to 5% lotus. Overall trends based on three

rotations show greater milk production when lotus is included as a companion forage in kikuyu grass pastures. Cows grazing pasture with greater than 15% lotus produced an average of 1.5 liters more milk per day than cows grazing grass-only pastures, a 21% increase in per cow milk production. According to this figure, at US \$.22 per liter, six dairy cows pastured on grass-only would yield approximately 1,354 liters of milk per month, providing an income of US \$284. The same cows pastured on a kikuyu-lotus association would produce 1,568 liters; the additional 277 liters would be sold for US \$61 (\$10 per cow), for a total income of US \$338 per month.

The largest obstacle to small-scale farmer adoption of pasture improvement is the large initial establishment cost, primarily in payment for labor. This research highlights the multiple benefits of intensively managed dairy pastures: greater per cow and per hectare milk yields and thus less area in pastures, forest regeneration on abandoned pasture land, and a concentration of production systems on fertile land close to the home. These changes would mean more productive farms, more agricultural and forested land, with greater flexibility for further income generation and diversification. The leadership role that farmers assumed in this research adds credibility to the results in the eyes of the farming community. This model has potential to be used in further improvement of livestock production systems in the region.

*Objective 5.3: Activities to increase the production of cultivated crops through practices to rehabilitate degraded systems.*

Design and introduction of non-native, herbaceous legumes to enable maize production on degraded soils in abandoned

fields (E), (Milofsky, M.S. thesis research in progress in collaboration with local farmers).

Rehabilitation of degraded irrigation systems with high potential for food production and cash crops (M). This is collaborative work funded largely outside of PLAN but with significant interactions and potential for PLAN objectives [Martínez et al., work in progress in collaboration with the Zenzontla Ejido, the Municipality of Tuxcacuesco, and SEMARNAP (government agency managing the biosphere reserve)].

**Activity Six: Improving Systems of Use and Conflict over Natural Resources community and local government officials).**

Conflict over land and other natural resources is of special interest to Project PLAN. Conflicts generally arise when socio-cultural, economic, and/or political forces bring about institutional changes or when institutions are weak and unable to enforce compliance with rules. For example, actors with economic or political influence may ignore legal ownership rights, even when titles are issued, if state property institutions do not have enough of a presence or do not have the resources to enforce rules of access and control. Another example arises from tenure system changes such as the transition from customary tenure to private ownership. This transition is often fraught with conflict as actors lose access rights that were recognized by the customary system but not under a private ownership system.

There are several implications of these conflicts for production systems and natural resource sustainability. Conflict may result in tenure insecurity: landholders are not sure what rights they have and whether they will be respected and recognized by fellow

community members, or by actors outside the community, including the state. This insecurity may contribute to practices that are not ecologically sustainable such as clearing land of trees in order to show possession and use, or over utilization of resources for immediate and short-term profit.

Another serious implication of conflict over natural resources is a sense of distrust among community members or with outside institutions and agencies. Conflicts and insecurity hinder participation by all community sectors in community development programs and activities with long-term objectives. In addition, when community and human resources are used to clear up or legalize property rights, they are then unavailable for communities to develop production and management practices that are environmentally and economically sustainable.

*Objective 6.1: Improve public understanding of issues relating to natural resource tenure systems, including use of natural resources, through education and development of mechanisms to enhance the capability of inhabitants to resolve conflicts and improve sustainable natural resource use.*

Initial characterization of natural resource tenure systems in the watershed and their impact on natural resource management have now been carried out in all three countries and summarized in a synthesis paper (Hernández et al., working paper (E); Vacaflores, working paper (B); Gerritson, working paper (M); Lastarria et al., three country synthesis working paper). Preliminary results, summarized below, show that conflicts arise out of a variety of situations: legal uncertainty because of indifference on the part of state institutions or state administration

incompetence, claims by powerful individuals who control vast amounts of natural resources that belong to smallholder communities, resource use regulations imposed by nearby natural resource reserves without consultation with neighboring communities, and distortion of customary rules by some individuals to gain control over a disproportionate amount of community land and resources. These conflict situations at a minimum hinder project activities by diverting community resources; in the worst case, they can directly contribute to unsustainable production practices and degradation of natural resources. The following gives a summary of our major findings.

**Access to land and natural resources.**

Access to land is a crucial factor in a rural household's ability to produce for both auto-consumption and cash income, including its ability to raise livestock. While the project communities in the three countries are generally smallholder communities, there are significant differences across community households in their access to land. Households with access to little land will be particularly constrained in their ability to raise livestock. For example, in Mexico, our research found that both quantity and quality of land are important. Eakright (2002) demonstrated that households with no land of their own managed only an average of 4 livestock, while households with extensive landholdings were able to manage 61 livestock (Table 1). Eakright also shows that households with relatively little but high-quality land are able to manage more livestock (12.8 heads) than families with more land but of low quality (9.3 heads).

Most community households (particularly in Bolivia and Mexico) utilize extensive grazing practices on other lands because their own land does not provide year-round forage.

Table 1 - Livestock owned and shared by land access categories

	Landless households (n=22)	Low-quality land households (n=8)	High-quality land households (n=11)	Extensive landholding households (n=2)
Average land owned (ha)	0.0	47.1	11.0	119.5
Average no. livestock owned	1.3	7.3	9.8	25
Average no. livestock shared	2.9	2.0	3.0	36

Source: Eakright 2002: p. 88

Moving cattle to other lands (e.g., crop field residues after harvesting) or areas (e.g., forests) at certain times of the year provides these households with forage sources. Grazing cattle off their own land, however, requires arrangements and negotiations with other households and, in some cases, even with other communities. These arrangements sometimes result in conflicts, which are generally resolved among community households based on customary norms and rules. A study in one of the Bolivia sites found that households seeking to diversify their livestock herd depend on informal institutional arrangements to provide collective access space and manage natural resources (such as land and forested areas) among those households that seek grazing areas (Vacaflores 2002). Interdependence among households to provide land, forage, and labor provides the rationale for households to abide by these customary norms. Thus while the form of cattle production has been characterized by low management input, this extensive system may require a fair degree of social management to arrange reciprocal access agreements and to monitor use patterns.

Another major finding with regard to access to land and other natural resources is the influence of state policies. Our research in Ecuador found that while state policies

provided access to frontier agricultural lands, state institutions also contribute to conflict situations. In the Cosanga area, the creation of a national ecological reserve in the midst of a settlement area has caused conflicts over management of natural resources between the reserve and the households that now find themselves in the reserve. In part, these conflicts are due to poor definition of reserve boundaries and of reserve regulations. In addition, the state agency in charge of issuing titles to settler families has been remiss in issuing those titles, creating conflict situations among early and late settler families. In one of the parishes, Hernandez et al. (PLAN working paper, 2002) found that parishes with a high incidence of land conflicts are those that fall within the reserve area.

*Objective 6.2: Inform local residents of legal aspects of land access, use, and ownership in order to secure tenure rights (E, B).*

While CER-DET has been working for a number of years to assist the tenure status of the Guarani lands (B) (this is work outside of PLAN), the design of an effective and appropriate support strategy for the other sites of PLAN is still in exploratory stages.

### **Activity Seven: Improving Food Security and Health at the Level of the Family and Community.**

To be truly sustainable, development must respond to the priorities of rural households and communities, particularly with respect to basic needs such as health and food security. Malnutrition and food insecurity are major health problems in a number of regions of Latin America, mainly affecting those living in isolated rural areas. Therefore, the purpose of a qualitative food security assessment was to determine its importance to local communities and to learn community members' perceptions about food insecurity, its causes and consequences for their families, the implemented coping strategies to confront this event, and the alternative interventions that they identify as sustainable ways of improving the local food supply and dietary quality.

Food security has been defined as "access by all people at all times to enough food for an active and healthy life." Adequate food availability does not necessarily translate into food security at the household or at the individual level. The disparate access to food results in a disproportionate distribution of the available food items in detriment of the most vulnerable. The assessment of food security at a household level should include the following aspects: 1) the quantitative component of having enough food; 2) the qualitative aspect concerning the types and diversity of food; 3) the psychological aspect of anxiety about deprivation or restricted choice of food; and 4) the social and cultural aspects of food acquisition. A food-security assessment was carried out in 8 communities (4 in Bolivia, 2 in Ecuador, and 3 in Mexico) using focus groups, transect walks, and interviews to answer the following objectives (Melgar-Quinonez and Zubieta, working paper).

*Objective 7.1: Identify systems and patterns of food production, acquisition, and utilization and preparation through household visits, discussion groups, and interviews with local authorities (B,E,M).*

The most difficult periods regarding food security correspond to seasonal limitations for crop and livestock production. In Mexico and Bolivia, people confront a reduction of their food supplies during the dry season, while in Ecuador, the rainy season is the worst period. The most vulnerable periods for food insecurity mentioned in Mexico were between June and September (dry season) and between December and January (before harvest). In Bolivia these vulnerable periods are between the months of July to November (food supplies become short due to extended droughts). Finally, in Ecuador the most difficult period is between February and September (due to the huge amount of rain, which causes flooding and loss of crops).

The main factor mentioned that contributes to food insecurity is the lack of money to buy enough food. The context of food insecurity was described as plagued by unemployment, very little local opportunities to work, lack of equipment and training in agriculture, reduction or lack of food aid programs, and reduced local availability of food. Food insecurity was also associated with low quality of available food items (i.e. absence of fresh foods). In a few cases, malnutrition of children was related to parasites and poor water quality.

Participants urged for more information and education in nutrition, as well as for training in how to produce and prepare foods that are perceived as nutritious and healthy. Food-based strategies and job opportunities were repeatedly mentioned as the desired approaches against food insecurity. Home gardening and small animal breeding projects

were mentioned in all three countries as the best alternatives to diminish food insecurity and malnutrition; however, the lack of knowledge in nutrition and the lack of training in how to develop gardens or to breed small animals was one of the main causes of food insecurity.

In all the communities, households (usually women) experimented on a trial-and-error basis with a wide range of species, such as chickens, turkeys, pigs, ducks, rabbits, guinea pigs, goats, sheep and trout (Activities 5 and 8). In general, chickens represent the most available source of animal food. Although the farm areas are big enough to develop a family garden and/or to raise small animals, in most of the cases farmers lack resources to grow vegetables or to take good care of their animals. Paradoxically, the lack of irrigation in Mexico and Bolivia and the abundance of rain in Ecuador are big hurdles in developing gardening projects. The protection of the gardens against small animal intruders is also one of the most important tasks to solve (see Activity 4). Fishing is a common practice in some of the communities (M, B)(Activity 4); however, pollution of the rivers has caused very critical problems in the availability and quality of the fish (small size, contaminated meat)(Martínez et al. working paper; Mercado-Silva, M.S. thesis).

*Objective 7.2: Evaluate food security status at household level, including dietary intake, sources of micro-nutrient-rich foods; consumption patterns and intra-household distribution. (B,E,M).*

Women showed a higher level of participation in the meetings, focus groups, and interviews carried out during our visits to the communities than men. In some villages it was not possible to arrange a meeting with

the men, who claimed to be too busy with their work on the field. Nutrition seems to be perceived by the men as a women's issue. In regards to intra-household food distribution, women reported that they eat last after their children and their husbands. This situation occurs more frequently when the household is facing food insufficiency.

In addition to the lack of food, participants related the concept of food insecurity to not having enough money to buy food (low accessibility). Food insecurity was associated with manifestations of psychological affection such as sadness and desperation, and to a permanent desire to eat. Food insecurity meant family conflicts between parents and a constant crying of hungry children. Consequences to children, as identified by the parents, were malnutrition and under weight, reduced school performance, and increased incidence of illnesses (diarrhea and upper respiratory infections). Adult's food insecurity was associated with illness, and a lack of motivation or energy to work.

*Objective 7.3: Infant feeding practices; Breastfeeding and weaning foods (B,E,M).*

When pregnant, women seem to have a limited number of foods available for consumption. The intake of animal foods, such as meat and dairy products, is very limited. Therefore, we can anticipate deficiencies in several micronutrients. Furthermore, breast-feeding women restrict their diet even more, especially during the first 40 days after delivering. This is a common practice in several Latin American communities. Infants, who in many cases are born undernourished, are started in sugar water and teas very early in life. These liquids take the place of milk and dilute milk's nutritional effect, creating a greater risk of sub-optimal nutrition. At the

age of 3 to 4 months, infants begin consuming complementary foods that are scarce in many nutrients. These foods are typically based on cornmeal, beans, oatmeal, and other cereals or legumes. These practices only add to the prevalent malnutrition situation that exists in these regions.

**Activity Eight. Improving household and community livelihood strategies through diversification, value-added options, and new alternatives. Support diversification of production systems to reduce the dependency on one system in order to support conservation of natural resources, to increase household security, and to minimize risk.**

*Objective 8.1: Completed study on current patterns of income diversification and livestock ownership.*

Completed study documenting patterns of household livelihood diversification and analyses of factors influencing household economic strategies, including gender analysis of livelihood diversification (M) (Morales, Licenciada thesis 2001; Eakright, M.S. thesis 2002, working paper 1; Young, M.S. thesis in progress, working paper in progress). Completed study modeling the intra-household aspects of livelihood diversification, focusing on different strategies of livelihood diversification by women vs. men (M) (Eakright, working paper 2).

Inter-household heterogeneity in incentives and constraints leads households down different pathways of income diversification. Quality differences in asset holdings result in different productivities and risk exposure across households. Also, property rights, labor availability, access to credit, and access to other markets differ across

households. The differences in investment patterns between income-poor and income-rich show patterns that are significant with respect to considerations of where and how to focus project activities to achieve project goals. The following provides a brief summary of findings:

Differences between income-poor and income-rich households:

- Amount and quality of land holdings:
  - a) Landed households earn much of their income from remittances (20%);
  - b) Remittance income positively correlated with returns to cattle and agriculture, and value of cattle herd.
- Types of and returns to small business activity:
  - a) Remittance income positively correlated with returns to small businesses;
  - b) Men's small business activities rated higher in returns and more likely in households of upper income quartiles.
- Social relationships and community participation:
  - a) Relationships of assistance are more common in lower income quartile households;
  - b) Friendships in towns of regional importance are more common in households of upper quartiles who are more mobile;
  - c) Male and female participation in community groups more common in middle-income households.
- Income diversification:
  - a) As income increases, so does specialization (however, the differences are relative—all the households sampled had scores indicating diversified lifestyles. This indicates that focus of any

development policy should not be number of activities, but increased returns to activities, and household well-being.)

- Small business income (especially women):
  - a) High return activities were done exclusively by women in top income quartiles and asset groups;
  - b) Greater multiplicity of small business activities by women in upper income quartiles and asset groups.
- Livestock / natural resources interaction:
  - a) Increase in income from traditional agriculture and remittance income will likely be accompanied by an increase in savings in cattle;
  - b) Increase in income to small businesses run by women often results in greater investments in small livestock over which they have greater control.

(from A. Eakright, M.S. thesis 2002)

*Objective 8.2: Implement locally appropriate household income diversification strategies for communities based on extensive livestock production (M,E,B).*

The activities to diversify household livelihoods include confined pig production (E), shade houses for vegetable production (E), fish culture (E), fruit extraction/production (M,B), home gardens (M), medicinal plants (M, B), handicrafts (B), fruit trees (M, E), and eco-tourism (E). These options for livelihood diversification link to numerous other activities through production of healthy, nutrient rich foods and protein for family consumption (Activity 7), use of non-timber forest products such as wild fruits or medicinal plants (Activity 4), and experimenting with

agro-forestry practices using fruit trees to improve production and sustainability (Activity 5). Activities with these options may serve as entry points to create trust and foster cooperation, e.g., Moreno's activities with women's groups in Zenzontla (see Activity 9, Objective 9.1; working paper).

*Objective 8.3: Gender analysis of agriculture, livestock, and natural resource use. Generate information regarding agricultural, livestock, and natural resource activities in which women participate. Identify opportunities for development and proposal of alternatives (B,E,M)*

- Completed focused gender analyses of activities and time use. (M)(Eakright and Zepeda, data collected, analyses mostly completed, writing in progress—preliminary analysis presented in GL-CRSP Annual Report 2001).

- Analysis of perceptions of specific gender roles with respect to natural resource management and decision-making. Case study based on detailed interviews with women and men of La Cueva (B)(Sansom, data collected, analyses in progress).

- Studies of differences in the types and bases of livelihood diversification for men and women of households (M)(see Objective 8.1).

- Study of the women's adoption of high-return activities in a Mexican Ejido (Eakright, working paper 2). The types of economic activities adopted by married women (portfolio choice) is dependent on their allocation of labor, which is strongly influenced by the amount and liquidity of their assets and by the amount and variability of her husband's income. Three different models were applied to understand how these factors affect their choices. The insights gained from these models help to explain observations from

the Zenzontla ejido in Mexico in which many poor rural women act similarly to asset-poor households, relying upon low-return, non-risky and easily divisible assets and activities in the non-farm sector for income-generation. The models also point to policy measures that would enable rural women to attempt activities with higher returns per unit labor such as improvement of women's labor assets through education, development of women's support groups at a community level, facilitation of the provision of credit and savings mechanisms for women, improvement of women's access to outside markets, and promotion of income-generating activities with low fixed costs.

*Objective 8.4: Development of the economic flow model to be used in all three countries.*

- Establish systematic data collection and database for storage and analysis of data, appropriate for measuring economic flows and community economic dependence in each country.
- Comparative study of two Mexican communities with differing degrees of proximity to and dependence upon the regional and national economy (student thesis; two papers to be written and submitted for publication by Moreno).

#### **Activity Nine: Strengthening Community Organizations and Local Planning Processes**

*Objective 9.1: Study of nature and operation of existing community organizations and actors, including the decision-making process and assessment of factors that favor and impede the formation and functioning of local groups.*

One of the four steps of the problem model is to promote and strengthen community planning; however, collective planning is difficult to achieve if there is a lack of effective organization at the community level. Promoting and strengthening community organization then becomes the more immediate objective as we proposed in our 3<sup>rd</sup> annual report. A broader study of these rural communities reveals that dispersed rural settlements in which people live on their land typically do not have a defined community structure, and that even where households are aggregated in villages, they frequently lack effective organization. Typically, a variety of divisive factors and conflicts work against cooperation and organization at the level of the community.

This situation led to the development of a different strategy with two complementary activities: one aimed at studying the main sources of conflict, i.e., those associated with use and access to natural resources and land (Activity 6). The other line of inquiry was to study the nature and function of organizations that exist in communities, such as producer's organizations, women's groups, etc. Both of these lines of inquiry have been fruitful (see Activity 6); the studies of the dynamics of small groups have increased our understanding of local social dynamics.

In Ecuador, K. Hernández completed a systematic inventory and characterization of small organizations in the communities surrounding our primary study site (preliminary results reported in our 4<sup>th</sup> annual report; working paper in progress). In Bolivia, Sansom just completed an in-depth case study of women's groups in two small, dispersed communities in La Cueva (M.S. thesis study in progress—data collection complete, analyses in progress).

These preliminary studies have contributed

to a fundamentally different approach to “community organization”—focusing our attention on strengthening and supporting small local organizations, especially producer’s groups and women’s groups (K. Hernández, working paper in progress—Ecuador). In Mexico, small-scale economic projects with women’s interest groups (see Activity 8, Objective 4) have fostered participation and cooperation in a situation that had appeared nearly unworkable (Moreno, working papers in progress—Zenzontla Ejido). This approach has not only increased our understanding of local social dynamics but has also identified potential mechanisms for promoting collective action and cooperation within these rural communities.

*Objective 9.2: Preliminary studies of the structure, nature, and operation of Guarani society.*

Under official conventions with the Guarani People (Assoc. Pueblo Guarani - Bolivia), two lines of inquiry have proved enlightening. 1) Analysis of Guarani community organizations and actors to determine the structure and function of their organizations at the community, zone, and regional levels (B)(Aguilar, preliminary study in conjunction with CER-DET). 2) Study of the Guarani education/learning system to increase understanding of how their ways of seeing and learning influence their use of natural resources (Lizárraga, 2000, working paper in progress). These studies are intended to inform community development processes, with hopes of improving how we work with these indigenous communities, and as a result, to improve their relationships with external actors and institutions.

*Objective 9.3: Design and establishment of management plans at the level of individual farms (E), communities (B,M), and communal lands (B).*

**Community management plans.** The Guarani communities in Bolivia are restructuring their communal plans. CER-DET (the key local partner of Project PLAN among the Guarani) is assisting in applying the focus, in a process developed by Project PLAN. This is ongoing work.

**Whole Farm Management Plans.** In the absence of local community organization, the PLAN-Ecuador team worked with an informal group of local farm families and encouraged whole farm planning as an option for those interested. At the request of individual farmers, these whole farm management plans were developed in a three-step process. First a diagnosis of the entire farm system was completed; then a management plan with costs and timelines was developed. Third, the farmer, with the assistance of PLAN, would implement the farm management plans using them as “management guides” to develop an improved, more productive, and more sustainable farming system. Plans were developed for three farms; two of those implemented these “management guides” with assistance of Project PLAN as examples for improvement. At the end of two years, these models have been judged successful by both farmers, with the result that 18 farms are now, with project assistance, in various stages of developing their own plans. One of these “model” farmers, Estalin Molina, now works as a community facilitator (an informal project “extension agent”).

Preliminary informal results of improvement as reported by farmers (Molina and Mosquera, working paper):

- Higher forage production through improved mix of forage species and better pasture management, including drainage canals on supersaturated soils and rotational grazing (see Activity 5, Objective 5.2);

- Increased costs of pasture improvement/management offset by decreased time weeding due to improved pasture health;

- Improved pasture health and longer term prospect of its productivity implies no need to follow the traditional pattern of cutting more forest to replace degraded pastures;

- Increased the future value of old and degraded pastures through silvo-pastoral and enriched plantings of native timber tree species (seedling obtained from a community tree nursery supported by the project);

- Increased milk production per cow per day (estimates of increases in liters per cow per day vary from a 40% increase to a 100% increase);

- Increased health of the cows with fewer dry cows and more births (time period still too short to verify these impressions);

- Overall high increase in profit per hectare and per farm (unverified estimates of increase vary from increases of 50% to 200%; confounding factors and limited data do not yet allow a rigorous assessment).

As a result of these successful perceptions, 15 farm households are now engaged in developing and applying plans. In addition, the local municipal government (the unit of local government responsible for regional planning, equivalent to county level in the U.S.) has asked Project PLAN to collaborate with them in the replication of this type of whole farm adaptive management throughout the canton. Also, we have heard that Nestle has become interested in the success of these plans and has begun encouraging some of their small dairy farm producers to develop similar management plans.

**Activity Ten: Linking local communities to local and regional institutions to support planning and policy for sustainable development.**

*Objective 10.1: Examine the effects of public policy on the use and management of natural resources.*

Preliminary analyses of the influence of external factors on patterns of change in local land use, livestock production, and use of natural resources point to the economic power and control of the market. The agriculture crises and the increase in the cost of land make it more difficult to gain access to enough land or pasture to maintain a herd of cattle. Those who have pastureland but no cattle find it more profitable to sell forage than to raise livestock. An increasing number of landowners are finding it more favorable to rent their land while they seek salaried, off-farm employment. This choice appears even more favorable for those with more education, leading to an increase in the migration out of rural communities (M)(Young, M.S. thesis in progress, working paper in progress).

Recent interest in the effect of globalization on the future of the dairy production system of the Quijos valley (E) (where PLAN is working) has produced data showing that the cost of producing one liter of milk under the improved conditions of the whole farm management plans promoted by Project PLAN are still significantly below the price per liter of milk on the open market. These analyses will be expanded this coming year (Calispa et al., working paper in progress).

*Objective 10.2: Design a plan to strengthen local natural resource management capacity at the scale of the watershed and region.*

Establish coordination mechanisms among natural resource management organizations and institutions, both internal and external to the community, in order to identify community sustainable management policies for the watershed (B,E,M)

In Ecuador, the Project has developed strong links with government officials at the Municipio level—a “county” level regional government that is very important for local policy, support of local community initiatives, and for coordination of activities in the region. This collaboration has continued to strengthen with the result that in July 2002, the Municipio officially invited representatives of PLAN Ecuador to participate in regional planning for sustainable development with its newly formed sustainable planning task force. Under decentralization in Ecuador, the Municipio now has primary responsibility for planning at this scale; therefore, this is a special opportunity for the community-scale planning processes and experiences of Project PLAN to inform planning at this much larger scale (Hernández et al., working paper in progress).

In Mexico, the large improvement project for Rio Ayuquila watershed, which includes important collaborators also in Project PLAN, has opened important levels of dialogue between regional governments and local residents about mutual interests in the sustainable development of natural resources and watershed protection. Project PLAN has been discussing future possibilities for the two projects to work together to link the community-based sustainable agricultural development focus of Project PLAN with the regional government training and environmental watershed planning activities of the Ayuquila project. In a meeting with the key leaders of that project in July 2002, we worked out a tentative working agreement outlining a plan for collaboration (Martínez

and Santana, working paper in progress).

In Bolivia, collaboration with Municipio officials of Entre Rios has continued. In addition, community members have been involved in meetings with municipal officials, thus serving an informal but increasingly effective role as facilitators for improved communication and support between communities and local government. In addition, JAINA has been developing a proposal for collaboration with the Municipio planning officials in the design of community planning models. Community and regional planning is the responsibility of the Municipio; however, they do not have the staff or training sufficient for the challenge. These officials have expressed interest in working with PLAN researchers as a resource to inform their planning. In April, with the backing and interest of the Municipio, JAINA presented a public demonstration of Project PLAN to inform the public and government officials about the nature of Project PLAN activities.

#### GENDER

Since its inception, Project PLAN has maintained a specific focus on gender issues and the needs of women in the project sites. More women are involved in the project every year: they are students, collaborators, community workers, and co-directors of partner organizations. The percentage of women in these roles is 43% for the project overall, with 58% women for the US team, 38% women for the Bolivia team, 31% women for the Ecuador team, and 41% women for the Mexico team. Women play an ever-increasing role in the management of the project itself. In Ecuador and Bolivia, women serve as directors or assistant coordinators of the project teams in their respective countries. We believe that encouraging women's

involvement in the overall management of the project is one of the best ways to assure that the opinions and needs of women will be included and addressed within the scope of activities on which we focus.

In the communities, women's issues play a central role in the development of strategies and activities. For example, in our assessment of food insecurity (Activity 7), women showed a higher level of participation than men in the meetings, focus groups, and interviews carried out during our visits to the communities. In some villages it was not possible to arrange a meeting with the men, who claimed to be too busy with their work in the fields. Nutrition seems to be perceived by the men as a woman's issue. In Bolivia and Ecuador, women have already determined ways of organization that allowed them to discuss local problems in order to identify interventions that might improve the economy of their households.

We have been working with women's groups at each site, and have identified specific objectives for the coming year to further develop the organization and activities of women's groups in all sites. In Bolivia, the strengthening of women's organizations is an identified priority for next year. The participatory research conducted in the communities of Fuerte Santiago and Rio la Sal last year will provide the foundation for these types of continuing activities. In Ecuador, a women's group in Cosanga has successfully ventured into collective small animal production for market. In year 6, the Ecuadorian team will continue to work closely with the women to develop plans to increase the size and return of the women's activities.

This year, the leader of the successful women's group in Ecuador, Dona Mariana Valle, was her community's representative at the project's annual planning meeting and

workshop in Mexico. Part of her participation included visiting one of the PLAN communities in Mexico and giving a talk about the work of her women's groups. Such participation of women in project planning and learning is essential to ensure that the perspectives, needs, and priorities of women will be addressed appropriately in the design and implementation of project activities.

In Mexico, a new member of our team is Dona Rosa Ramirez, who as a native of the community of Cuzalapa and current resident in Zenzontla, serves as a liaison and community organizer on the Mexican team. We are excited about this relationship and believe that her collaboration with the project will provide the community and us with a wonderful opportunity to work together, making an effective bridge to exchange ideas and increase understanding on both sides. She participated in our annual planning meeting in Mexico and provided important insights into the perspectives of farmwomen on rural development. Gathering the communities' perceptions of development will be one of the most important and fascinating aspects of this relationship. Our increased documentation of processes occurring in the communities, a specific objective for Year 6 in all three countries, will provide valuable insight into the processes that inhibit or encourage development of women's organizations. This information will in turn allow us to design focused strategies for supporting women's activities in the years to come.

Several of our activities deal primarily with women's interests, such as Activity 7: Improving food security and health at the level of the family and community. Family food security issues directly concern women, as they are often principal decision-makers in terms of food purchase and preparation. In regards to intra-household food distribution,

women reported that they eat last after their children and their husbands. This situation is more recurrent when the household is facing food insufficiency. During these periods, women ensure that other family members eat the existing foods, serving themselves smaller portions when available. On the other hand, men are not aware of this inequality. They describe this inequality as a normal family practice.

An activity designed to improve the quality of life of women is Activity 8: Improving household and community livelihood strategies through diversification, value-added options, and new alternatives. Objective 8.3 under this activity deals with “gender analysis of agriculture, livestock, and natural resource use to generate information regarding agricultural, livestock, and natural resource activities in which women participate and to identify opportunities for development and proposal of alternatives.”

Perhaps one of the most exciting developments of our project for the coming year is the possibility of instillation of a micro-credit, or seed fund, program to be earmarked specifically for activities of women. In all three countries, project collaborators will work closely with women to design, develop, and implement strategies for utilizing seed funds as a tool for the diversification of livelihoods. These activities will be directed towards providing opportunities for women to positively affect their quality of life as well as that of their families.

## POLICY

Collaborating with governmental bodies within the three countries will be one of the ways we can most positively influence sustainable management in the long term. For this reason, we have focused Activity 10 on

strengthening linkages between local government, regional institutions, and local groups for the purpose of affecting planning and policy issues in the areas where we work. The linkages that we have fostered in the past years provide us with the strong background on which to build the deeper relationships between project team members and government officials necessary to succeed.

During the past years, key local counterparts (IMECBIO in Mexico, FUNAN in Ecuador, CER-DET, AGROSIG, and JAINA in Bolivia) have developed the authority to work in the region and thus have working agreements with local authorities and communities. In Mexico, we have a collaborative working agreement with SEMARNAP (the government agency that administers the biosphere reserve) that includes the primary target communities and related communities into which studies and activities have been extended. The regional scale work on the Ayuquila River watershed revealed great potential for regional interaction with several government agencies at state (Jalisco) and national levels.

In Ecuador, FUNAN continues to work directly with the new Ministry of the Environment, the government agency in charge of natural resources and the administration of the Reserva Ecológica Antisana. All four institutions collaborating with PLAN-Ecuador work with the Municipio in Baeza, the regional government authority that includes the area of our project. In Bolivia, we have a collaborative relationship with the administration of the Reserve Natural de Fauna and Flora Tariquia (our project is in the buffer zone of this reserve), and the Dirección General de la Biodiversidad in the Ministry of Sustainable Development and Planning. Our partner, AGROSIG, works at our site under a convention with the Municipality of

Entre Rios to assist planning in the region, including both our site areas. Project team members will continue to foster all of the relationships.

The process of supporting planning and policy for sustainable development will follow a logical sequence of events. Assessment and investigation of current processes, as well as identification of “entry points” where collaboration will more likely be successful and may be used as a model for further interventions in other sites, will be one of the first on the chain of activities for the PLAN team. The involvement of Jan and Cornelia Flora in planning these steps will bring experience, insight, and ideas for collaborating with different institutions. This focus and concentration on policy issues will encourage an environment for long-term planning.

In Bolivia this year, there will be a comprehensive study of the structure and function of the OTB (Organización Territorial de Base) of La Cueva. This study will inform the next steps in the strategy for sustainable planning in the OTB, and shape efforts on the part of our Bolivian colleagues to collaborate with the local government structures. The study will be conducted by field personnel who have worked very closely with the community and local officials in the past, and will act as a model for further studies of its type.

#### OUTREACH

Outreach activities have been extended to include not only educational activities for children but also public presentations of the activities of Project PLAN in cooperation with local governments (Bolivia and Ecuador). Project PLAN’s focus on supporting and strengthening activities and skills of women’s groups, producers’ groups, and community groups has created

opportunities for outreach activities with local people.

Outreach from the farming communities: One very exciting aspect of our Annual Workshops, which began in year 3 and has continued into this year’s annual planning conference and workshop in Mexico, is the participation of community members involved with project activities in their villages. This included one Bolivian from the Guarani community, Cesar Aquilar, and two Ecuadorian farmers, Estalin Molina and Mariana Valle, and several farmers (two women and three men) from our Mexican communities of Zenzontla and Las Ventanas. Mariana Valle, a leader in establishing a women’s group in Ecuador, gave a presentation to the community of Las Ventanas describing how this women’s group designed and carried out their own experiments to evaluate three local breeds of pigs and then presented their findings. We cannot overemphasize the value of this type of farmer-to-farmer exchange. Their participation and presentations to fellow farmers have been extremely valuable in the ongoing efforts for furthered community understanding, exchange, and outreach. This is an example of the project facilitating outreach among farmers and providing opportunities for them to directly influence the activities of the project. We are committed to continue this pattern of farmer participation in future workshops.

#### DEVELOPMENTAL IMPACT

In previous workplans, we have outlined our long-term goals of the project through two main purposes. These goals envision a series of related impacts on different scales. We have added an additional one this year pertaining to impacts on participating institutions.

Desired impacts of Goal A at the scale of rural communities in livestock-based forested ecosystems are to: improve productivity, economic well being, quality of life, and promote the sustainable use of ecosystems and watersheds and protection of biodiversity.

Goal B (develop a general set of processes, strategies, tools, and methods (a “tool kit”) useful for implementation of community development and natural resource management projects by local people in conjunction with external agents) is intended to create the means to propagate the impacts of Goal A over larger regions.

Our preliminary progress assessment provides evidence for the efficacy of the process represented by the S-shaped curve. We are committed to a long-term period of work with our target communities, including developing the means for propagating our work within the surrounding regions. We expect, by the end of year 6, to have a relatively complete “tool kit” ready to apply to other communities in the region. Our “tool kit” to this point includes a list of strategies and processes to strengthen vision, create trust, and foster inclusivity and two-way learning. It is holistic (integrating both research and development), participatory (involving adaptive management plans), bottom-up in development approach, and process oriented. A paper on this will be completed in the coming year to widen the impact of the project.

A new third goal, and very real impact of our project, is the increased capacity of local institutions and researchers (our project’s institutional partners and individual team members) to approach this problem through the demonstration of an integrated interdisciplinary approach to environmental problem-solving. Participating organizations have changed in a positive way. The training of 22 students in this approach, in addition to

their specialty, will have a very real impact in the development organizations that many of them will join in the future.

People involved in Project PLAN, by their own admission, have been developed professionally in a positive way. We suggest this is due to the participatory way of working with each other, the multiple-way exchange and learning process we have jointly created, the interdisciplinary, holistic scope of our project, the nature of our common “dream for the project,” and the positive feedback we have all received from working with the families of our target communities. Institutional changes of our partners will be documented in the coming year, since these changes have long been perceived but not yet recorded. The information will be disseminated in order to increase our impact.

#### **Environmental Impact and Relevance.**

Sustainable use of forested ecosystems: In Bolivia, indigenous communities have been organized to move from extensive production of livestock to semi-intensive production, involving pasture grasses, leguminous trees and forest managed for forage (160 participants, half women). In the coming year management plans will be implemented in three other cooperatives that have already fenced in their pasture areas.

#### **Agricultural Sustainability.**

**Productivity:** In Ecuador, through farm planning and increase of the legume Lotus in pasture, milk yields have doubled with consequent economic benefit and forest regeneration in degraded pasture (currently 8 farms or 60% of the community with 3 more to be implemented and all documentation finished in the coming year).

**Household Security.** Economic well being: In Mexico, a study of the use of a native tree's fruit (traditionally valued by the local community for cattle forage) has found that the commercial production of a coffee substitute from its seed is economically feasible, potentially benefiting 9 families. This would result in alternative sources of income as well as restore riparian areas, potentially reducing impact of livestock on the forest. A women's co-op is being organized and funding will be sought in the coming year.

Impact on quality of life: In Mexico, the use of Lorena stoves for cooking has reduced exposure to smoke from cooking fires and use of firewood by about 50%. This is a special benefit for women, since within the family they are the primary users of stoves. Some 85 stoves have been built by their owners in the last year, over half of which have been directly facilitated by Project PLAN. In the next year we plan to expand the contract of the promoter as we attempt to keep up with requests for training in making the stoves.

**Contributions to U.S. Agriculture.** This project is intended to be used as a demonstration approach for selected visiting farmer representatives from the U.S. "Farmer to farmer" exchanges would allow U.S. farmers to have seen firsthand the development of sustainable livestock practices and watershed scale integrative community planning processes. This aspect of the project has had to be postponed due to the severe limitation of funds, though in our year four meeting in Madison, WI, a few farmers from Ecuador and Bolivia did have a chance to exchange experiences with livestock farmers from Wisconsin. Our initial "experiments" with active participation of our host-country community representatives has given us a clear understanding of how we could further involve

U.S. farmers in a meaningful exchange. This possibility will be further developed in year 6 and/or phase II of the project.

**Contributions to Host Countries.**

- Increasing the capacity of local institutions and researchers to approach land use problems through an integrated interdisciplinary approach and a variety of shared participatory methods and perspectives. We hope to increase this in year 6 with the incorporation of Centro de Investigación Agricultura Tropical's (CIAT) workshops on participatory technology development.

- Assessment of the nature of land use problems and potentials in sensitive areas of Latin America with regard to:

- pasture degradation;

- loss of biodiversity and biological resources, watershed degradation, and consequences for water supplies and environmental problems (flooding, etc.); and

- poverty and potential for regional economic development.

We are developing and assisting local and regional efforts to increase the welfare of rural small landholders and rural communities, increasing a sense of empowerment. This will contribute to overall economic stability and development for the host country.

- The large number of host country students that are involved with Project PLAN through an adjunct thesis project has greatly increased. These students are contributing important information and experience to the project and the institutions involved. Most of these students are men and women who wish to continue working in the conservation and sustainable development field. These students will be the leaders of this type of action in their respective regions in the future. We believe that good natural resource management decisions are based in good science, and the

students involved with Project PLAN assist constantly in fomenting this connection.

- Our commitment to strong effective communication among organizations and partners involved with our project has enabled free exchange of information. This in turn has allowed the strengthening of capacity of all colleagues and community members in the loop. Exchange of ideas and experiences has proven to be extremely valuable in the on-going nature of the project. Host countries and domestic team partners alike have expressed the sentiment that the movement of information among groups has been one of the highlights of involvement in the project.

**Linkages and Networking.** Project PLAN is constantly increasing its number of contacts and ties to people and organizations within the member countries as well as internationally.

The process of fostering valuable working relationships among organizations in Bolivia and Ecuador is ongoing. Positive results are evidenced by stronger ties and increased collaboration among host country partners. Partner NGOs have strengthened their ties to the people's organization of the Guarani in Bolivia, and continue to explore ways to work with this organization for the good of all. The Pueblo Guarani have enlisted our partner NGOs in Bolivia to assist with such projects as production of fabrics and other handicrafts by local women. The relationship between the NGOs in each of the countries is constantly getting stronger as projects and ideas develop.

Project PLAN has generated a tremendous amount of valuable information and opportunity for exchange among the three countries, as well as other outside institutions. In order to make this experience accessible to a large number of people, we have established a website that outlines PLAN milestones and

contains information about the range of activities we have undertaken. This resource, along with our continued email exchange of information, allows all parties involved to remain within the communication loop that makes our project so strong. We are proud to maintain open lines of communication and exchange ideas that foster an environment of trust, collaboration, and mutual respect that gives everyone involved a sense of community within the project itself. Continuing plans for PLAN workshops and meetings also foment an environment conducive to a shared partnership and vision.

**Collaboration with international research centers.** The majority of our collaboration efforts have focused on organizations within the countries with which we work directly. We hope that, as our project continues to grow and focuses more on specific issues, we can extend our network base to other organizations involved in similar important work throughout the world.

We have initiated discussions with CIAT (the International Center for Tropical Agriculture), which opened exchanges with Joachim Voss (the Director General of CIAT) during his visit to Madison last spring. We followed this with a visit of PLAN researcher Susana Lastarria-Corniel to CIAT headquarters in Colombia to talk with several different researchers about possible collaborations with respect to 1) forage improvement, 2) participatory research tools and training, and 3) rural agro-enterprise development.

#### OTHER CONTRIBUTIONS

Benefits of the project for the U.S. will be quite diverse, and will concentrate principally on the strengthening host country stability. Benefits include: increased productive

capacity within host countries as sources of materials and as markets, increased democratization in the region, and conservation of biodiversity and biological resources. This is especially important in light of recent terrorist attacks on the symbols of U.S. economic and military power. Terrorist activity is thought to be fueled by poverty, disenfranchisement, and hopelessness.

One of the benefits of our PLAN project — and the stress that we place on participation by local NGOs and locals — is an increased sense of empowerment, an antidote to the disenfranchisement.

This participation can increase the status of and respect for the U.S., and ultimately affect its ability to further its agenda in the world through a type of “soft” power, different from military and economic power. This “soft” power refers primarily to the good will engendered in others (foreign individuals, groups, countries) due to our values, our generosity, and our perceived capability of “doing good.” Soft power may be increasingly important as a complement to military and economic power in the fight against terrorism as it undermines the hopelessness that begets negative destructive action. When the world sees Americans as being helpful and supportive via projects like PLAN, this can only help the status of and cooperation with the U.S. in world affairs.

#### LEVERAGED FUNDS AND LINKED PROJECTS

Substantial leveraged funds have been obtained by our partner institutions in each country for projects related directly or in part to PLAN goals and activities. The total leveraged funds for our non Wisconsin partners was \$221,714 (Bolivia \$86,000; Ecuador \$69,561; Mexico \$48,163; Food Security partners [Melgar-Quinonez &

Zubieta] \$28,000). For each partner, the individual grants are listed and the portion of funds applicable to PLAN activities is listed. For each grant we list 1) the source of funds (donor); 2) principal investigator(s) of PLAN; 3) title or purpose of the proposal; 4) funds used for PLAN activities; and 5) duration of the grant.

#### **Food Security Activity: \$28,000**

- The University of California Institute for Mexico and the United States (UC MEXUS) Grants for Collaborative Projects, Hugo Melgar-Quinonez & Ana Claudia Zubieta, Development of a measurement tool to assess food insecurity in communities located in the Sierra de Manantlán biosphere reserve, \$25,000, Jun 2001-Dec 2002

- Gifford Center for Population Issues— Small Grants for Research on Population; Food and the Environment sponsored, Hugo Melgar-Quinonez & Ana Claudia Zubieta; Testing of a Household Food Security Tool in Rural Communities of La Cueva, Bolivia; \$3,000, Jun 2002-May 2003

#### **Bolivia: \$86,000**

- Gifford Center; Jesús Molina, Study of farmer-originated experiments, \$3,000 Oct 2001 – Sep 2002

- University of California Davis; Jesús Molina, Study of farmers’ experiments, \$7,000, Oct 2001 – Sep 2002

- PIEB (Programa de Investigaciones Estratégicas Bolivia); Carlos Vacaflores, Study of transhumance systems, \$20,000, Jun 2001 – Mar 2002

- COSUDE (Cooperación Suiza para el Desarrollo); Ricardo Del Carpio, International Year of the Mountains, \$1,500, Dec 2001 – Apr 2002

- DfID; Pilar Lizárraga, Municipal planning in Entre Rios, \$2,500, Mar 2002 – Jun 2002

- DfID ASDI; Pilar Lizárraga, Study of local political participation, \$5,000, Feb 2002 – Jul 2002

- INTERMON; Grover Maella and Henry Valdez, Community commercialization of corn, \$10,000, Aug 2000 – Aug 2003

- INTERMON; Angelo Lozano, Sustainable livestock management, \$15,000, Aug 2002 – Aug 2003

- Broderik Denle; Orlando Corzo, Study of the incidence of pig tapeworm in the Tomitarena watershed, \$2,000, Sep 2001 – Sep 2002

- Interamerican Foundation; Cesar Aguilar with Alipio Valdez; Participatory study of the Guarani People's Assembly; \$1,500, Jan 2002 – Jul 2002

- Interamerican Foundation; Hernan Ruiz with Ruben Cuba, Development of community plans, \$10,000, Sep 2000 – Sep 2002

- INTERMON; Milton Borda with Angelo Lozano and Grover Maella, Study of three species of grass to improve forage available for cattle, \$5,000, Dec 2001 – Dec 2002

- INTERMON and Interamerican Foundation; Carlos Tapia with Hernan Ruiz, Market study of the community commercialization of corn, \$2,000, Feb 2001 – Aug 2002

- Production and Social Investment Fund; Marcela Pona with Ricardo Paita, Study of the food security of Guarani communities in Itika Guasu, \$1,500, Jan 2002 – Aug 2002

**Ecuador: \$69,561**

- PROBONA; Fundación Antisana, Develop initiatives with local residents for sustainable use of soils and forests, \$15,000, Jan 2000 – Jan 2002

- The Nature Conservancy / USAID; Fundación Antisana, Support Conservation of Biodiversity the Antisana and Cayambe – Coca Ecological Reserves, \$22,630, Oct 1997

– Oct 2001

- British Embassy; Fundación Antisana, Develop initiatives with local residents for sustainable use of soils and forests, \$24,931, Jan 2000 – Jun 2000

- Municipio Baeza; APROPAL, Construction of bridge and trail for ecotourism, \$7,000, 2001

**Mexico: \$48,163**

- Zucarmex; Luis Manuel Martínez, Rio Ayuquila, \$13,500, 2000

- Instituto Nacional de Ecología; Luis Manuel Martínez y equipo PLAN, Programa de Desarrollo Rural Sustentable, \$4,183, 2000

- UdeG.-Investigación; Luis Manuel Martínez, Manejo y Conservacion del rio Ayuquila, \$3,750, 2001

- UdeG- Acude; Luis Manuel Martínez Rivera, Arturo Moreno y Jesús Rosales, Manejo de sistemas Agropastoriles, \$1,500, 2001

- PACMYC- Jalisco; Arturo Moreno, Rescate del conocimiento de la Herbolaria, \$3,000, 2000

- Ude G- Investigación; Arturo Moreno, Análisis de la economía rural de zonas marginadas, 1,700, 2000

- UdeG- Acude; Arturo Moreno, Trabajo comunitario, \$800, 2000

- UdeG- Investigación; Arturo Moreno, Mercado y comercialización de Ganado Bovino, \$3,570, 2001

- UdeG- Acude, Arturo Moreno, Planificación de la Unidad Campesina, Integral, \$1,500, 2001

- UdeG- Producción Agrícola; Arturo Moreno, Intercambio campesino México-Ecuador, \$1,200, 2002

- National Fish and Wildlife Foundation; Sarahy Contreras Martínez, Impacto de la ganadería sobre las aves del ejido Zenzontla, \$5,560, 2000-2002

- UdeG.; Sarahy Contreras Martínez,

Ecología y conservación de aves en bosques tropicales y templados, \$5,000, 2000-2001

- UdeG; Oscar Cárdenas, Análisis de los patrones de cambio en el uso del suelo en la Reserva de la Biosfera Sierra de Manantlán, \$2,900, 2001

### TRAINING

#### *In Progress:*

Samuel Adaut, Engineer, 2003, Agronomy, Universidad Autonoma Juan Misael Saracho, Bolivia

Milton Borda, Bachelor of Science, 2001, Agronomy, Universidad Autonoma Juan Misael Saracho, Bolivia

Carlos Tapia, Bachelor of Science, 2001, Agronomy, Universidad Autonoma Juan Misael Saracho, Bolivia

Orlando Corso, Bachelor of Science, 2001, Veterinary Science, Universidad Autonoma Juan Misael Saracho, Bolivia

Linder Espinoza, Ph., D., 2005, Engineering, Universidad de Sevilla, Bolivia

Juan Carlos Ronquillo, Bachelor of Science, 2002, Botany, Universidad Central, Ecuador

Alejandra Velez Izquierdo, Bachelor of Science, 2002, Economía Agrícola, Universidad Autónoma Chapingo, México

Evelia Reyes Castelan, Bachelor of Science, 2002, Economía Agrícola, Universidad Autónoma Chapingo, México

José Bernardino Llanes Espinoza, Bachelor of Science, 2002, Economía Agrícola, Universidad Autónoma Chapingo, México

Eduardo Gallardo Vazquez, Bachelor of Science, 2003, Economía Agrícola, Universidad Autónoma Chapingo, México

Felipe Guzmán de Jesus, Bachelor of Science, 2003, Economía Agrícola,

Universidad Autónoma Chapingo, México

Arturo Baltazar Camacho, Bachelor of Science, 2004, Biodiversity, Universidad de Guadalajara-CUCSUR, México

Juan Antonio Rodríguez Durán, Bachelor of Science, 2004, Biodiversity, Universidad de Guadalajara-CUCSUR, México

Octavio Gutierrez, Bachelor of Science, 2003, Natural and Agricultural Resources, Universidad de Guadalajara-CUCSUR, México

Elisa Marbella Flores Preciado, Bachelor of Science, 2002, Natural Resources, Universidad de Guadalajara-CUCSUR, México

Jose Julian Zamora Duran, Bachelor of Science, 2002, Natural Resources, Universidad de Guadalajara-CUCSUR, México

Carla Verónica Blanco Castellanos, Bachelor of Science, 2003, Biology, Universidad de Guadalajara-CUCSUR, México

José Félix Ramírez Zavalza, Bachelor of Science, 2002, Natural Resources, Universidad de Guadalajara-CUCSUR, México

Gabriela Melendez, Bachelor of Science, 2002, Soil Science, Universidad de Guadalajara-CUCSUR, México

Rafael Pérez Rangel, Bachelor of Science, 2002, Irrigation, Universidad de Guadalajara-CUCSUR, México

Oscar Cardenas-Hernandez, Ph.D., 2003, Natural Resources, University of Wisconsin-Madison, México

Tessa Milofsky, MS, 2003, Agronomy, University of Wisconsin-Madison, USA

April Sansom, MS, 2003, Conservation Biology & Sustainable Dev., University of Wisconsin-Madison, USA

Barbara Whitelaw, MS, 2003, International Agricultural Development,

University of California-Davis, USA

Michelle Young, MS, 2002, International Agricultural Development, University of California-Davis, USA

*Completed:*

Herlan Valdivieso, Engineer, 2001, Agronomy, Universidad Autonoma Juan Misael Saracho, Bolivia

Nelson Flores, Engineer, 2001, Forestry, Universidad Autonoma Juan Misael Saracho, Bolivia

Verónica Morales Segura, Bachelor of Science, 2001, Economía Agrícola, Universidad Autónoma Chapingo, México

Juan Pablo Esparza Carlos, Bachelor of Science, 2002, Natural Resources Management, Universidad de Guadalajara-CUCSUR, México

Alexis Eakright, MS, 2002, Conservation Biology & Sustainable Dev., Applied and Agricultural Economics, University of Wisconsin-Madison, USA

Louise Galazo, MS, 2002, Conservation Biology & Sustainable Dev., University of Wisconsin-Madison, USA

Yoyi Hernandez, MS, 2002, Conservation Biology & Sustainable Dev., University of Wisconsin-Madison, USA

Norman Mercado-Silva, MS, 2002, Land Resources, University of Wisconsin-Madison, USA/México

*Short term:*

Project PLAN Annual Meeting and Workshop, July 22-28, Autlan, Mexico. This meeting was geared primarily towards the important and useful process of restructuring our list of activities into a more coherent and concise format, along with planning strategies for the upcoming stages of the project. Country teams

met in groups to create workplans for their respective teams, as well as to discuss possible publications from team members and next year's project-wide output goals.

**COLLABORATING PERSONNEL**

*United States of America:*

Albrecht, Ken, Professor, Agronomy, UW-Madison

Galasso, Louise, Graduate Student, UW-Madison

Hernandez, Yoyi, Graduate Student, UW-Madison

Laca, Emilio, Professor, Range Science, Univ. California, Davis

Lastarria, Susana, Researcher, Sociologist, UW-Madison

Melgar-Quinonez, Hugo, Researcher, Nutrition and Public Health, Univ. California, Davis

Mercado-Silva, Norman, Graduate Student, UW-Madison

Milofsky, Tessa, Graduate Student, UW-Madison

Moermond, Timothy, Professor, Zoology and CBSD, UW-Madison

Murphy, Alexis Eakright, Graduate Student, UW-Madison

Nordheim, Erik, Professor, Statistics and Forestry, UW-Madison

Rosemeyer, Martha, Professor, Agroecology, Evergreen State College

Sansom, April, Graduate Student, UW-Madison

Wattiaux, Michel, Researcher, Animal Science, UW-Madison

Young, Michelle Graduate Student, Univ. California, Davis

Yuill, Thomas, Director, Professor, Veterinary Science, UW-Madison

Zepeda, Lydia, Professor, Economics,

UW-Madison

Zubieta, Ana Claudia, Researcher, Nutrition and Public Health, Univ. California, Davis

*Bolivia:*

Baldivieso, Herlan, Student, Climate and Botany, Agrosig

Calla, Rhinda, Sociology, JAINA

Cari, Christina, Agronomy, CER-DET

Carranza, Freddy, Agronomy, JAINA

Del Carpio, Ricardo, Agronomy, Business, JAINA

Castro, Miguel, Director, Lawyer, CER-DET

Corzo, Orlando, Student, Animal Science, CER-DET

Cuba, Ruben, Agronomy, Botany, CER-DET

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**PUBLICATIONS**

*Articles:*

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*Articles not supported directly with GL-CRSP funds:*

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*Theses not supported directly with GL-CRSP funds:*

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#### ABSTRACTS AND PRESENTATIONS

Hugo Melgar Quinonez and Ana Claudia Zubieta, "Food Insecurity in Latin American Rural Villages: A Qualitative Assessment," poster presented at the International conference on Animal Source Foods and Nutrition in Developing Countries, Washington, DC, 24-26 June, 2002.

Susana Lastarria-Corniel, "Community Planning for Sustainable Livestock-based Forested Ecosystems in Latin America," presentation to CIAT, Cali, Colombia, 14 May, 2002.

Marcia Penafiel, "Study of the temporal changes of vegetation cover and soil use in the Cosanga watershed, Ecuador" presented in a poster to the VIII Congreso Latinoamericano de Botánica (Cartagena de Indias, Colombia), October 13 – 18, 2002.

Katty Hernández, "General use of natural resources and organizational participation (PLAN - HPI), presented to a working group which focuses on use and management of natural resources in Ecuador, August 30<sup>th</sup>.

strategies, which identified our strengths and weaknesses as well as opportunities to increase the value of our research. The evaluators, Drs. Keith Moore and Ahmed Sidamed, identified important advances already achieved that required systematic documentation to define the nature of these achievements and the processes that appeared most important in achieving these results. The evaluation validated our participatory and holistic approaches and recognized the operation of our team as a learning organization. Their recommendation that we concentrate our efforts on community-based sustainable development and action research encouraged us to focus our initiatives, in order to develop a more integrated and more effective research/development approach.

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#### COMMENTS

For Project PLAN, the EEP site visit to Ecuador and subsequent evaluation was extremely valuable for us in several ways. The conduct of the visit served to facilitate a critical examination of our goals, assumptions, and