SUMMARY REPORT: BASELINE STUDY ON CATTLE PRODUCTION SYSTEMS AND DEGRADED PASTURE LANDS IN PETEN, GUATEMALA, CENTRAL NICARAGUA AND NORTHERN, HONDURAS

PROJECT TITLE: CAM-2242

NORAD – CATIE
APRIL 2002

Summary report: Baseline Study on Cattle Production Systems and Degraded Pasturelands in Peten

1. Project Title: CAM-2242 "A Baseline Study on Cattle Production Systems and Degraded Pasture Lands in Peten, Guatemala , Central Nicaragua and Northem Honduras".

2. Implementing Institution: CATIE

3. Project design (goal, objective, and outputs):

The Development Objective of the Project is:
Small-medium cattle farmers (< 150 ha) in humid areas of Central America have adopted sustainable, more productive, diversified management systems that include the use of tree/shrub components.

The Immediate Objective of the Project is:
A multi-stakeholder participatory methodology to evaluate pasture land degradation in Central America, which will provide a framework to judge the effectiveness of bio-physical, socio-economic and political interventions to improve land use in cattle ranching areas, has been developed.

Outputs:

- M&E system proposed for the evaluation of the impact of silvopastoral, forestry and other interventions on degraded pasture lands in Central America;
- Key bio-physical, socio-economic and political baseline variables related to pasture degradation identified;
- Recommendation domains proposed for different classes of pasture degradation in each target zone and for the Central American region; and
- Logical framework and proposal developed for a regional project to recover degraded pasture lands in three zones in Central America.

4. Progress of implementation

Expenditure in relation to budget

The expenditures in relation to funds budgeted for different items or activities are shown in Table 1. Unallocated funds were spent for contracting local consultants, to collect field data for bio-physical analysis of pasture degradation, organise field events with farmers, and to gather secondary information. National workshops were replaced by direct consultation with stakeholders to obtain information on bio-physical, socio-economic and political variables related to pasture degradation, and for this reason unallocated funds were used to contract national consultants. Workshop costs were also reduced through co-financing (e.g., CIAT and USDA). Unallocated funds were also used to cover difference of cost for purchasing of computer equipment, and to contract secretarial services to support project activities (e.g., organisation of two regional workshops). The project provided some funds to NINA expert (Graciela Rusch) to travel from San Jose to visit the pilot area of Nicaragua with the objective of gathering information for the preparation of a joint CATIE/NINA research project proposal.

All financial contributions for project activities from different sources are given in Table 2. The contributions from CATIE and other sources were higher than predicted, principally because the parallel development of the GEF-BM silvo-pastoral project lead to major contributions of relevant information. Total expenditure was US173,656.80 in which NORAD contributed 59.7%, CATIE 21.3% and other sources 19.0% of the total expenditures. The GEF silvopastoral project contracted consultants (US20,000) to make bio-physical and socio-economic evaluations of silvopastoral systems for sustainable animal husbandry in Nicaragua, Costa Rica and Colombia, and the data from these studies are also being used to formulate the proposal to NORAD for the recovery of degraded pasture lands in Central America.

Table 1. Budget (US$) for degraded pasture lands project granted by NORAD.

Item	Budget	Expenditure	Balance
Consultants	33,200.00	37,418.50	-4,218.5
Travel and per diem	17,000.00	11,880.94	5,119.06
Workshop	25,000.00	29,710.83	-4,710.83
Computer /Equipment	3,500.00	4,509.99	-1,009.99
Laboratory	6,000.00	4,665.42	1,334.58
Communication	4,100.00	3,546.00	554.00
Contingencies	8,880.00	0	8,880.00
Overhead	12,698.00	11,925.12	772.88
Totals	110,378.00	103,656.80	6,721.20

Table 2. Contribution of funds (US$) from NORAD, CATIE and other institutions (e.g., CIAT, Zamorano and USDA)

ITEM	NORAD	CATIE	OTHER	TOTAL
Consultants	37,418.50			37,418.50
15% silvopastoral expert (M.Ibrahim)		13,500.00		13,500.00
5% Agroforestry expert (J.Beer)		2,500.00		2,500.00
International experts (USDA and CIAT; US300/day*10 days)			3,000.00	3,000.00
Local experts (6 persons*20 days*US$25/day)			3,000.00	3,000.00
1 M.Sc student (field research)		15,000.00		15,000.00
20% Field Assistant		2,000.00		2,000.00
Travel and per diem	11,880.94	2,500.00	2,000.00	16,380.94
Workshops	29,710.83	1,500.00	5,000.00	36,210.83
GEF-silvopastoral proyect-consultants			20,000.00	20,000.00
Computer equipment	4,509.99			4,509.99
Laboratory services	4,665.92			4,665.92
Communication	3,546.00			3,546.00
Overhead (13%)	11,925.12			11,925.12
Total	**103,656.80**	**37,000.00**	**33,000.00**	**173,656.80**

a. GEF international consultants: Jose Gobbi, Patrick Dumarazet and Javier Botero; b. Int. Travel and Workshops: experts from FENAGH, NITLAPAN, DICTA, University of San Carlos, USDA, CIAT, Zamorano, CATIE and international consultant.

Actual outputs compared to planed outputs

OUTPUT 1. M&E SYSTEM PROPOSED FOR THE EVALUATION OF THE IMPACT OF SILVOPASTORAL, FORESTRY AND OTHER INTERVENTIONS ON DEGRADED PASTURE LANDS IN CENTRAL AMERICA

Activities

- Two regional workshops were organized in which sixteen participants, including local and regional experts, participated to develop the elements of an M&E system. Criteria for selecting pilot areas in each target zone in the three countries were established in these workshops.

- The M&E system proposed was evaluated and modified with local experts in the three countries

- CATIE staff, including a M&E expert, drafted a possible M+E system based on a sub-set of potential variables suggested during the workshops (**Annex 1**). This has yet to be tested in the pilot areas.

Summary of results of output 1

- Pilot areas were selected according to the criteria (**Annex 2**) agreed with stakeholders such as farmer's organisations (e.g., FENAGH, Matagalpa livestock farmer's association), local-national (e.g., NITLAPAN and INTA – Nicaragua; DICTA and LEYDE-Honduras; Centro Maya, MAG, ICTA and Banrural-Guatemala), regional (e.g., CATIE, Zamorano) and international institutions (e.g., CIAT and USDA). The pilot areas selected are: Muy Muy-Rio Blanco (Matagalpa, Nicaragua); Juncal- Aguan River (Olanchito, Honduras); and El Chal-Dolares (Peten, Guatemala). The size of each pilot area is approximately 100 – 210 km^2.

- M&E system was developed to evaluate pasture degradation and recovery. This system includes key economic, social, bio-physical and political indicators that will be monitored to evaluate impacts of pasture degradation and recovery. The variables, indicators and methods to evaluate these were developed for pilot area, farm and community levels that must be considered in each pilot area. Although the project is focussed on pilot areas, the intention is to also to monitor some variables and indicators at the national level. Hence monitoring and evaluation will be needed at the plot, farm, community and national levels:

A. Plot level. In permanent sample plots/points, at the beginning of the intervention (technology change) and again 3-5 years later when the 1st phase is near to or has been completed. Students could carry out a major part of the studies though the project should ensure that it has some human resources (technical staff and assistants) to collect data in cases where international students (e.g., from CATIE's postgraduate programme) or national students (e.g., from

Zamorano and other Universities) are not available. Some of these studies (primarily bio-physical) could be carried out by collaborating scientific organizations such as CIAT/USDA/NINA, but always promoting maximum participation of farmers, local professionals and students.

B. Farm and community level. Bio-physical M+E will principally be carried out internally by the project team and collaborators (includes students, local experts and policy/decision makers) as described above for plot level evaluation. M+E of socio-economic variables will largely be the responsibility of independent external consultants, though the project team and collaborators will have to quantify and provide some of the required information. Although a good data base is available for the Nicaraguan pilot area (partly thanks to a GEF-WB project), this will have to be complemented in the other two pilot areas (Guatemala and Honduras) with specific studies carried out at the beginning of the 1st phase of this regional project. At the end of this 1st phase, studies should be repeated in all three pilot areas, using adequate representative sampling, to quantify and describe qualitative changes in key variables. Some initial work is still needed by the project team, collaborators and external consultants to choose these key variables and ensure that they have been adequately evaluated to provide a solid base line from which impacts can be objectively determined. Documentation of levels of implementation (e.g., number of participants in farmer field schools) will be the responsibility of the project team; it is planned to adapt the MIP-AF-NORAD experience to design this internal control process.

Quality assessment (e.g., of training events of extensionists) should normally be carried out by independent consultants who may be contracted at any time during project implementation (by the project team) in order to promote a dynamic process of internal reflection and improvement. Such "internal" assessments would normally be kept separate from project evaluations ("external"; carried out by donors, national Governments and/or head office institution staff and their consultants) in order to promote full involvement, acceptance and use of the results by the project team and collaborators.

C. National level. M+E at the national level will be both longer term (little impact at this level may be evident at the end of the first phase) and less easily quantified due to the nature of the variables and larger number of factors (individual, projects, institutions) that may have been influential. However it would be possible to quantify levels of involvement (participation) of both municipal and national leaders / politicians (responsibility of the project team) and their knowledge about / understanding of the issues and interventions that are being developed / promoted to improve land use. This latter evaluation should be attempted at the end of the 1st phase by independent consultants who could be contracted internally (by the project team) or externally (by the donor etc). There seems little point in attempting to provide a base line for this national evaluation, in part because there will be a large turnover in this target group during the first phase.

Funding for the consultants and additional assistants, who will be contracted by the project team to contribute to the M+E system (i.e., the internal management tool used to dynamically plan and guide the project), has been included in the suggested budget. External evaluation costs are not considered. The preparation of contract details, including precise Terms of Reference for each consultant involved in M+E, will be the responsibility of the project team. The project team, sometimes assisted by consultants, will also need to keep track of external factors that influence

M+E indicators; e.g., interest rates, product prices (and availability of markets), security issues, other parallel influential initiatives or projects, climate change, etc.

Deviations from plans:

National workshops were replaced by direct consultation with farmers and farmer's groups, as well as local and regional institutions, since this permitted more equal participation of all interest groups and more in-depth discussions with each. Farmer´s often use different variables/indicators to those chosen by scientists/technicians and farmers provide far more information/suggestions in the field than in the (for them) artificial environment of a workshop based on concepts such as logical frameworks.

OUTPUT 2. KEY BIO-PHYSICAL, SOCIO-ECONOMIC AND POLITICAL BASELINE VARIABLES RELATED TO PASTURE DEGRADATION IDENTIFIED

Activities

- Basic information on cattle and land use systems was collected and a data base created.

- In each pilot area, farmer's cooperatives and livestock leaders were contacted to obtain the list of cattle farmers in the area. A questionnaire was prepared in consultation with these local stakeholders and applied to 60 randomly selected livestock farmers in each pilot area to obtain biophysical and socio-economic data of each farm.

- Local experts contracted by CATIE, worked with farmers and local organisations in the pilot zones to ascertain their knowledge and perceptions of pastureland degradation and practices used to recover degraded pastures. They also collected secondary information related to biophysical, social, economic and political conditions in each of the pilot areas.

- Fifteen farmers in each pilot area were randomly selected to make the biophysical analysis. In Nicaragua, pastures were sampled for: dry matter (DM) production and botanical composition; soil cover; tree populations; and soil fertility as well as soil bulk density. In Honduras and Guatemala, pastures were only sampled for DM production, botanical compositions and tree populations because of insufficient funds for soil fertility analyses. Farmers were asked to rank each pasture that was sampled in terms of the level of degradation and this information was corroborated with laboratory analysis.

- Land use changes. Satellite images were used to make a classification of cover in the pilot areas. Recent aerial photographs are not available for the three pilot areas and therefore it was not possible to make a more detailed analysis of cover and land use systems. Community leaders and knowledgeable farmers, who are acquainted with the history of colonization of the pilot areas, were consulted to analyse trends in deforestation and land use patterns in the pilot areas.

- In Nicaragua, a socio-economic evaluation was made to determine how small and medium sized cattle farms could benefit from the adoption of silvopastoral systems. The analysis included: i) increase in productivity and income generated with livestock products; ii) reduction of farmer's risk by diversification of farms with silvopastoral and other technologies; iii) environmental benefits (Carbon and biodiversity) farmers could "sell" by adopting silvopastoral systems; iv) impacts on rural poor (e.g., source of employment); v) methodology to monitor environmental services; vi) potential impacts on women; and vii) barriers for adoption of silvopastoral system. This study was funded by the GEF Silvopastoril project.

- Institutional analyses to determine strengths and weakness of relevant institutions were conducted.

Summary of results **(In Annex 3 is presented a detailed summary of the baseline study)**

- Livestock production is the principal activity in the pilot areas selected. 95% of farmers interviewed depended on livestock production as one of their principal sources of income.

- Pasture degradation is a common denominator in the three pilot area; more than 80% of pastures in Muy Muy and 50% in Juncal and El Chal-Dolares are moderately to severely degraded.

- The bio-physical analysis showed that improved pastures usually degrade between 5 to 7 years. Degradation is linked with: 1) establishment of pastures in fragile land (e.g., hillsides); 2) overgrazing in the dry season; 3) frequent prolonged dry seasons; 4) burning of pastures; and 5) nutrient depletion. Degraded pastures are characterized with a low percentage (< 40%) of desirable species and ground cover, and low concentrations of soil P.

- The percentage of desirable grass species and ground cover of pastures are the main criteria farmers used to evaluate a pasture and to make a decision to abandon a degraded pasture. Pastures are usually abandoned when desirable species are below 40%.

- In the three pilot areas, livestock and crop production are integrated. Farmers have a tradition of abandoning degraded pastures to regrowth of secondary forest (3-5 years), subsequently cleared to produce crops (beans and maize) for two cycles and then replanted to pasture. Analysis of land use dynamics with farmers showed that the period for regrowth of secondary forest or fallows has decreased over the last decade (e.g., from 6 - 10 to 3 – 5 years) and this is linked with pasture degradation. A decrease in the period under secondary forest regrowth is related to: i) increased population; ii) decreased farm productivity; and iii) progressive increase in the area of degraded pastures on farms.

- Average annual rate of pasture renovation is 5% which is below the estimated annual rate of degradation of 12%; this explains the progressive increase in the area of degraded pastures on farms.

- Cattle owners are not generally the rural poor. The very poor rural families in the study areas are landless livestock dependent people who do not own cattle. In the three pilot areas, about 70% of the population live in extreme poverty whereas the average at the national level varies between 10 to 20%. Only 10 to 20% of livestock farmers live below the poverty line. The majority of the poorest rural families are landless but they have some dependence on livestock farms. Traditional livestock systems are not very labor intensive (1 – 2 field workers/farm). More than 50% of the livestock farmers surveyed rent land to landless poor for the cultivation of subsistence crops (maize and beans).

- The surveys showed that there is a tendency for rural poor (landless and with land) to migrate to the agricultural frontiers; e.g., 15 cases were recorded in Muy Muy between 2000 and 2001.

- The socio-economic analysis conducted by the GEF silvopastoral project in Matiguas, Nicaragua showed that the implementation of silvopastoral systems (on 30% of total farm area) on small cattle farms (average 40 ha; average annual income/farm of US$3000) will result in an increase in income generated on farms (> 70%) and the number of farm workers contracted (from about 1.0 to 3.5 workers/farm). In all pilot areas it appears that women in livestock farm families have a better situation compared to women in families that produce subsistence crops and/or are landless. In Muy Muy and Juncal, 15 to 18% of women are involved in milking cows and cheese processing. A larger percentage of women (> 50%) in livestock farm families are involved in the management of small livestock, including pigs and poultry, that are important sources of protein for home consumption, and a source of capital for generating income in difficult times, e.g., sickness, purchasing of school books and uniforms.

- More than fifty percent of pastures have some tree cover which under better management systems will result in increased and diversified farm productivity as well as enhancing conservation of biodiversity.

- A small percentage of farmers (10 to 15%) have been adopting technologies to increase feed supply in the dry season. This includes sowing of fodder banks for cut-and-carry dry season supplementation.

- The pilot areas are in close proximity to conservation sites and degraded pastures have negative impacts on conservation of biodiversity. The project should promote better overall land use planning (not just focus on pasture areas).

- The extension services in the pilot areas are very limited in terms of the critical mass of extensionists and technical areas covered. In Muy Muy, more than 70% of farmers have access to extension services compared to 7% in Juncal and El Chal-Dolares. In Muy Muy, NITLAPAN is providing technical services to farmers and CATIE is providing training to NITLAPAN staff for subjects such as sustainable animal husbandry. CETA (Centre For Formation Of Technicians) is also involved in training technicians in this zone

- The main local institutions working in research on pasture and livestock production are INTA in Nicaragua, DICTA in Honduras and ICTA in Guatemala. These institutions have a narrow focus with respect to management of livestock systems.

- In the three pilot areas there has been a drastic reduction in the amount of credits offered in the agricultural sector because of privatization of services and closure of development state banks. Farmers access to credits is 48.3% in Muy Muy, 41,7% in Juncal and 11.9% in El Chal-Dolares. "Postmitch" development programs, which included credits for farmers, were set up in Juncal and Muy Muy; this explains the larger percentage of farmers with credit in these zones.

- More than 50% of farms in the three pilot areas have good year round accessibility which reduces costs for transporting farm products and inputs, and the cost of technical and credit services. Farmers in Muy Muy and Juncal benefited from the post-Mitch reconstruction of highway and road networks. In Guatemala, a highway was constructed linking the Peten to Guatemala City and Mexico. This has permitted the Peten to export beef to Mexico. In Muy Muy and Juncal, there are acceptable markets for milk products (Honduras and Nicaragua are exporting local cheese to El Salvador and USA). Most farmers supply liquid milk to LEYDE in Juncal and to PARMALAT and PROLACSA in Muy Muy.

Deviations from plan:

The assessment of the evolution of land use changes were made with satellite images because aerial photographs are not available for the selected pilot areas. More work is needed to evaluate the political (national) variables which affect land use (positively or negatively); with the limited resources and time frame of this base line study, this aspect could not be adequately covered and should be a priority for a following project.

OUTPUT 3. RECOMMENDATION DOMAINS PROPOSED FOR DIFFERENT CLASSES OF PASTURE DEGRADATION IN EACH TARGET ZONE AND FOR THE CENTRAL AMERICAN REGION

Activities:

- Best bet technologies were defined for different livestock production systems in the pilot areas.

- The GEF silvopastoral project conducted a detailed ex-ante analysis of best bet technologies considering: improvements in farm productivity and environmental services.

- Revision of secondary information on pasture degradation and cattle production systems in different agro-ecological zones in Central America. Information was also collected on social, economic, biophysical and political aspects related to pasture degradation and cattle production systems in these agroecological zones.

• Revision of GIS based maps on classification of cover and land use systems

Summary of results:

Within pilot areas, a stratification of livestock farms and livelihood of livestock farmers was made based on: farm size, land use, number of livestock units, sources of income and fixed capital. An integrated land use approach should be promoted to reduce pasture degradation and for diversification of farms. Alternative land use systems should be based on a sound analysis of agro-ecological and socio-economic conditions and markets for products with commercial potential. Farm plans should be developed with farm families utilizing a dynamic participatory approach (e.g., experience of CATIE-MIP-AF-NORAD project).

On all farm types fodder banks should be established to solve the problem of dry season feed shortages which are linked to overgrazing and pasture degradation. Fodder banks can be established on sloping moderately degraded pasture sites close to animal feeding pens using high yielding persistent tree and shrub species, to be managed by cut-and-carry system for animal feeding. Excess fodder produced in the wet season should be conserved as silage. In Matiguas there are good examples where small farmers are using low cost silos (silo "sincho") for conservation of forage for dry season feeding. In all pilot areas farmers have some experience of locally adapted fodder species (e.g., *Gliricidia sepium* in Juncal; *Leucaena* sp. and *Brosimum alicastrum* in El Chal-Dolares) that can be used for establishing fodder banks.

On moderately degraded less fragile areas (< 25 % slopes) improved silvopastoral systems should be promoted using native (and adapted exotic) multi-purpose trees that have commercial and service value. In Juncal and Matiguas, there are good examples of traditional silvopastoral systems with high value native multi-purpose trees such as *Platymiscium pinnatum* (locally known as cristobal or coyote) and *Pithecellobium saman* (locally known as genizaro) and *Guazuma ulmifolia* (locally known as guacimo); the latter is also commonly found in traditional systems in Peten. Training and technical assistance should be provided to women groups for the commercial production of high quality seedlings of timber and multi-purpose tree species.

Improved herbaceous grass legume silvopastoral systems should be established in areas where farmers are renovating degraded pastures. In all the pilot areas improved pastures are generally established on sites where secondary forest is first converted to crop cultivation for a period of one to two years. In the cropping phase multipurpose trees (e.g., for silvopastoral systems) should be planted (about 8 m x 8 m) at the beginning of the crop cycle as this will permit good survival and growth rates and reduce the risk of severe damage by animals in the pasture phase. The grass legume mixture will be planted once the cropping cycle has ended. These silvopastoral systems will help to support higher carrying capacities, and contribute to soil improvements and diversification of farm products, as well as liberating fragile areas for re-afforestation. Silvopastoral systems will increase seasonal distribution of forage compared to traditional monoculture grass systems, and therefore farmers will not have to practice burning of pastures to promote pasture re-growth.

On severely degraded pastures, natural forest regeneration should be promoted. This is a very cost effective way of increasing the forest cover on farms especially for small and medium sized cattle farmers. However, on many of these sites there may not be sufficient seed rain or seed pools in the soil to enhance rapid regeneration and therefore enrichment planting may be required to increase the tree density. CATIE's experience with enrichment planting should be used to manage secondary forest. Well established secondary forest (e.g., > 3 years) on flat and less sloping lands can be managed for browsing at low stocking rates during the dry season because these systems are generally characterized with forest and shrub species that have high fodder value.

On larger cattle farms where land is not a problem, forest plantations with native and or adapted exotic species should be established. Smaller farmers who are constrained by available land and resources for investing in forest plantations, should establish trees in border line planting so as to increase timber production. In El Chal-Dolares many farmers are using dead fence posts which are more expensive (replacement) compared to live fence posts. The use of multipurpose trees and high value timber species can be used to develop multi-strata living fence lines. This system should be promoted in all livestock producing systems. In Juncal there is a dominance of diary farms and exotic diary breeds; multi-purpose trees should be established in the pastures to provide shade to animals as well as other services.

In all tree pilot areas inadequate cropping systems (e.g., slash and burn) have been linked to pasture degradation. On some hillside pilot areas of Nicaragua and Honduras, farmers are using mixed cropping systems with leguminous cover which has proven to improve soil fertility and increase crop productivity. This technology should be promoted for the rural poor who are cropping lands on livestock farms.

Technical assistance and training should be provided to relevant institutions (e.g., INTA in Nicaragua; DICTA in Honduras; and ICTA in Guatemala) to develop more sustainable systems. For example, technical support should be given to research and extension institutions and farmer's organizations to design and implement programs and projects focused on sustainable animal husbandry. Industrial milk plants, including Parmalat in Nicaragua and LEYDE in Nicaragua, should design technical programs for promoting sustainable animal husbandry. In El-Chal-Dolares, technical assistance should be provided to the farmer's dairy cooperative in areas related to production, milk processing and handling.

The pilot areas are representative of sites (ecosystems) where livestock production is being practiced in Central America. The methodologies, experiences and lessons learned on pasture degradation and recuperation in these pilot areas will be complementary and applicable within large areas of Central and Latin American region where the socio-economic, political and biophysical settings are similar. In El Chal-Dolares Peten, beef cattle production systems are the main ranching systems whereas in Juncal, Honduras and Muy Muy, Nicaragua the production systems are more oriented to dual or only dairy production. By working in these three pilot areas, the common cattle production systems in Central America will be targeted. Cattle production is generally practiced in the humid (e.g., Atlantic zone of Costa Rica, Ceiba-Honduras, Bluefields-Nicaragua) and sub-humid zones (e.g., Esparza-Costa Rica, Estelli and Rivas- Nicaragua,

Olanchito-Honduras): the results of the pilot areas in Nicaragua and Honduras will cover these domains. The ecosystem of the Peten is representative of the Yucatan (Mexico) and the district of Cayo, Belize and hence results can also be extrapolated to these areas. It is expected that the results generated in this project will be applicable to about 150,000 small and medium cattle farmers in Central America who manage about 6 million hectares of pastures

Deviations from plans:

Recommendation domains can be defined using general variables that describe average socio-economic status and environmental conditions; e.g., medium sized beef farm on calcareous soils of the seasonally dry Peten. However to attack the problem of degraded pastures site specific solutions are needed, and these will vary within the pilot areas and indeed within each farm. Except at the very general level, the validity and utility of recommendation domains is questionable. The project team has adopted a different approach where the focus is on developing local capacity to evaluate and propose solutions to problems at the plot level rather that pretending that some general recommendation is applicable to a broadly or narrowly defined set of criteria; i.e., instead of trying to "average" the heterogeneous conditions in a pilot zone or farm, the team will work with farmers to develop methods that are based on the evaluation and use of localized variability.

OUTPUT 4. LOGICAL FRAMEWORK AND PROPOSAL DEVELOPED FOR A REGIONAL PROJECT TO RECOVER DEGRADED PASTURE LANDS IN THREE ZONES IN CENTRAL AMERICA

Activities:

- A regional workshop was held in December 2001 in which fifteen experts from various institutions (national, regional and international) participated. The activities in this workshop were: i) presentation and discussion of baseline data on pasture degradation; ii) identification of problems associated with pasture degradation; iii) definition of the opportunities for recovery of degraded pasture lands defined; iv) discussion of the potential participation of national and regional stakeholders in the proposed project; and v) development of a logical framework for a proposed project to recover degraded pasture lands in the three target zones in Central America.

- The proposal is still in preparation (70% completed) and will be submitted to NORAD in May.

Summary of results:

- Logical framework developed for the proposed project "Multi-stakeholder participatory approach to develop sustainable land use alternatives for degraded pasture lands in Central America" (**Annex 4**) The objectives and outputs are listed below:

DEVELOPMENT OBJECTIVE

Livestock farm families and communities in Central America are managing more sustainable and diversified land use systems that generate social, economic and environmental benefits.

IMMEDIATE OBJECTIVE

Key institutions and farm leaders in Central America, including CATIE, have strengthened research, teaching, training and development programs with social, ecological and economic approaches for alternative land use of degraded pastures.

OUTPUTS

Output 1. Researchers, extension agents and farm families have designed and tested sustainable land uses, that generate diversified commercial products, for the recovery of degraded pasture lands in three pilot zones of Central America;

Output 2. Collaborating institutions/organisations and farm families have develop participatory group learning and experimentation methods (farmer field school) to strengthen farm family skills to remedy and avoid pasture degradation at the field and farm level;

Output 3. Pilot zone extensionists and collaborating scientists have improved their knowledge and skills to work with livestock producing families to identify and manage alternative land uses for areas of degraded pastures;

Output 4. Policy makers, national institutional and municipal leaders have used information, methods and tools developed by the project to monitor and evaluate pilot zone activity as well as identify policy alternatives for wider of more sustainable land use; and

Output 5. Project team have employed adequate management mechanisms for the effective planning, documentation, monitoring and evaluation of program outputs and objectives that will contribute to improved land use in areas with degraded pastures.

Deviations from plan: none

Problems of risk. The project has ended and therefore there is nothing to report on problems of risk for the baseline study. However, among the problems of risk identified for the potential regional project "Multi-stakeholder participatory development of sustainable land use for degraded pastures in Central America" are:

- appropriate land use policies are promoted by Governments in target countries;
- the project will have political and institutional support;
- the project has been adequately funded;
- external market institutions do not cause distortions on farm activities
- land tenure reforms do not affect farmers in the pilot area
- major natural disasters do not occur which affect project activities;
- civil wars do not affect project activities

5. Assessments

Efficiency of project activities

Project funds were used to contract an international expert consultant to coordinate activities in the three countries (and with CATIE HQ in Costa Rica), analyze data and present the final report. At the country level, national experts were contracted to gather secondary information and to coordinate field activities. Students of UNA in Nicaragua, Pan American Agricultural School (Zamorano) in Honduras, and University of San Carlos, Guatemala participated in the field surveys to characterise livestock farms and to sample soil quality and pasture attributes. Students were trained for these activities and received some minimal incentives from the project. A CATIE MSc student received logistical support from the project to carry out an in-depth analysis of pasture degradation with cattle farmers in Peten. Farmer's organisations and leaders were involved in mapping the distribution of cattle farms, and to make an analysis of colonisation and land use patterns in each pilot area. CATIE contributed experts to coordinate the implementation of the project and to provide technical support to develop methodologies, to analyse and interpret data of the field studies as well as to write/edit project documents (reports/proposal etc). CATIE also provided part of the logistical support (secretarial and administrative) to the project. Technical support was also obtained from CIAT and USDA; three experts from CIAT and USDA participated in both regional workshops. These institutions also provided a major part of the travel expenses for the participation of their experts in these workshops. At the country level, there was support from NITLAPAN in Nicaragua, Zamorano in Honduras and PDS (Sustainable Development Program) in Peten to realise field activities and to coordinate visits to different institutions and organisations. The GEF silvopastoril project contracted consultants for the identification of best bet technologies for livestock farms, and to carry out a socio-economic evaluation of these technologies. The results of these studies have been incorporated into the proposal to be presented to NORAD. Because of the limited budget and time available, the base line activities were focused on the pilot areas. Studies at the national level could not be efficiently nor effectively carried out at this stage. Although no formal calculation of cost effectiveness, nor of alternatives to achieve the same outputs, has been carried out, the amount of information collected and the quality of the relationships established (e.g., inter-institutional) indicate that this base line study was extremely cost effective, principally because of the quality of the consultants and collaborators but also because of the level of co-funding that was obtained. The M+E system needs further development, which will only be possible in a larger implementation project; this is essential to demonstrate that the proposed pilot activities to remedy practices that lead to pasture degradation (proposed regional project) can indeed have a significant positive impact. The decision to use most of the baseline study resources to organize on-farm and local consultation not only permitted a better understanding of farmers´s perceptions but also lead to the establishment of closer inter-institutional relationships in each country, which will be very valuable for the efficient implementation of the proposed regional project.

Adjustments of activities planned

As mentioned above, in consultation with experts in the first regional workshop and with local stakeholders, it was agreed to substitute the national workshops with direct consultations with institutions, organisations and especially farmers to gather information on key bio-physical, socio-economic and political variables related to pasture degradation. There was a consensus that participants in national workshops would be very diverse with corresponding divergent interests, making it difficult to achieve the objectives of true consultation with all stakeholders through national workshops.

It was planned to use aerial photographs to evaluate evolutionary changes of vegetation cover and land use systems in time, but aerial photographs for the pilot areas are not available and it was not feasible to obtain them with the resources and time available. As a result, satellite images were used to map the vegetation cover and land use in each pilot area. A short workshop was carried out with key informants in each pilot area to map changes in cover and land use systems. The evaluation of key political and other variables at the national scale was not feasible in this base line study although relevant information was obtained through the activities in the pilot areas; for example, preliminary identification of laws and national regulations which affect land use in these areas.

It is recommended that in the first phase of a follow-up project, aerial photographs and/or the new IKONOS remote sensing system should be used for each pilot area so as to make a more detailed analysis of the vegetation and land use systems. A study of relevant national laws/regulations, and a preliminary mapping of the extent of different general recommendation domains at the national level, using remote sensing methods, should also be part of the first phase of the proposed regional project.

Relevance of the project compared to defined needs and concerns

Indicators (biophysical and socio-economic) were determined for monitoring and evaluation of the impact of the solutions and strategies proposed for the recovery of degraded pasture land in Central America. These include: area of pastures and percentage degraded, forest cover, percentage desirable species and ground cover in pastures, soil fertility, stocking rate, number of field workers contracted on farms, farm production, fixed capital of farms, gender participation, poverty indices of rural populations in the pilot areas, etc. These variables were included in the monitoring and evaluation system developed to evaluate pasture degradation and recuperation.

Integrating silvopastoral systems on cattle farms will result in an increase in farm labour needs and provide economic as well as environmental benefits. These are major incentives for smallholders where the opportunity cost of labour is very low and where additional labour can be supplied by farm families or landless rural poor. The proposed project thus includes a focus to link poor to non-poor as one way of reducing poverty.

Farmer's have a good knowledge of pasture degradation; the main indicators they used to evaluate pasture degradation were the percentage of desirable grass species and ground cover. However, an analysis with farmers showed that they were not making rational use of their resources. Sowing of improved grass monocultures were the main practices that were promoted by farmers to recover degraded pastures, but the analysis with them showed that these pastures

degrade again within 3 to 6 years. Cropping practices used by the rural poor are damaging the environment and the proposed project should include a focus to educate and promote better cultivation practices by this target group; i.e., consider the whole farm and all who depend on it and not just the livestock component and the farm owner. This will aim at long term sustainability of crop yield, improved social well being of rural poor, and a reduction in environmental degradation.

The proposed project should promote the use of improved pasture, silvopastoral, forestry and other crop technologies for the recovery and productive use (including environmental services) of degraded pasture lands. This should be based on the adaptation of existing knowledge and local experience in order to develop locally applicable alternatives. The educational methodology should be based on principles of participation, adult learning and empowerment for decision making using the FAO farmer field school and CATIE/NORAD MIP-AF participatory ecological reasoning approaches.

There is little direct participation of women in farming activities in the three pilot areas though they certainly play a major role in decision making. The proposed project will promote greater participation of women; for example, evaluations of the role women play within the family in decision making that affects land use, diversification and the profitability of the different farm activities; organization and training of women groups; support of women groups to be involved in the management of community nurseries and small agro-businesses; involvement of women in participatory training events, etc.

The national technical institutions that support animal husbandry have a narrow focus to develop technologies and provide training and technical assistance to livestock farmers, generally focused only on the men. The proposed project will attempt to strengthen these technical institutions by promoting integrated programs for sustainable animal husbandry. This can be done by providing participatory training and technical assistance to the institutions. Technical support should also be given to institutions involved in providing credits and incentives to programs for the diversification and sustainable land use of livestock farms.

The international, national and local concerns about the economical and environmental consequences of present livestock models, which usually lead to widespread pasture degradation, have been and will be addressed at different levels (plot, farm, community and/or watershed, national), integrating bio-physical and social, cultural, economic and political factors. This complex approach can not be expected to provide immediate widespread solutions but if correctly implemented it offers the best option to address the needs and concerns of all stakeholders and achieve sustainable improvements in land use in degraded pasture areas.

Annex 1. Potential variables to be used in a monitoring and evaluation system to evaluate recovery of degraded pasture lands

SCALE	THEME	VARIABLE	INDICATOR	METHODOLOGY
Plot	**Biophysical**			
	Edaphic	- porosity and compaction	- infiltration of water	- use of infiltration ring method developed by USDA
		- soil erosion	- frequency and area of pastures with gullies	- count and measure area along transects
			- area of pastures with rills	- count and measure area along transects
		- nutrient deficiencies	- colour of pasture	- visual observation of young leaves using ranking method
		- susceptibility to compaction	- % bare soil or cover	- fixed sampling point in field using quadrat
		- soil fertility	- production of biomass	- use of BOTANAL method
			- % weeds and desirable species	- fixed sampling point in field using quadrat
		- nutrient cycle and physical soil protection	- amount leaf litter	- quantification of litter in fixed quadrat
		- compaction	- bulk density	- use of cylinders and penetrometer
	Hydrological function	- infiltration rate	- acceptance of water	- use of infiltration ring method developed by USDA
		- surface runoff	- area of pastures with gullies	- count and measure area along transects
			- area of pastures with rills	- count and measure area along transects
		- compaction	- bulk density	- fixed sampling point in field using quadrat
		- soil moisture conservation	- amount of leaf litter	- quantification of litter in fixed quadrat
		- porosity	- % porosity	- measurements in soil pit
	Biotic	- water availability for plants and micro-organisms	- infiltration of water	- use of infiltration ring method developed by USDA
		- productivity of pasture	- colour of pasture	- visual observation of young leaves using ranking method
			- amount of forage available	- use of BOTANAL method
			- incidence of pest and diseases	- use of insect traps and visual ranking of disease symptoms
		- vigour of pasture	- % weeds and desirable species	- fixed sampling point in field using quadrat
		- productivity of trees and shrubs	- amount of edible fodder and fruits	- field sampling to quantify edible foliage
		- biological activity of soil	- presences of residues and litter	- fixed sampling point in field using quadrat
		- presence and distribution of roots	- root length and depth	- measurements in soil profile
		- inventory of trees and shrubs	- abundance of species	- use of circular plots and counting
			-richness	- use of circular plots and

				counting
			- population dynamics	- use of circular plots and counting
			- index of tree dispersal	- use of GIS images and distance meter
Farm	**Biophysical**			
	Land	- land use	- area of pastures	- farm surveys, use of GIS images and ground truthing
			- area of pasture with trees	- farm surveys, use of GIS images and ground truthing
			- area of secondary and primary forest	- farm surveys, use of GIS images and ground truthing
			- area of annual and permanent crops	- farm surveys, use of GIS images and ground truthing
			- area of pastures on steep slopes	- farm surveys, use of GIS images and ground truthing
			- dispersal index of land use system	- use of GIS images
			- % change in farm area	- interviews with farmers
			- % change in area of degraded pastures	- use of GIS images and interviews
	Production	- forage/fodder	- area of pastures with > 70% desirable species in the rainy season	- interviews and case studies
			- area of pastures with > 70% ground cover	- interviews and case studies
			- Production of forage/ha	- case studies and field sampling
			- production of tree foliage and fruits/ha	- case studies and field sampling
			- stocking rate in the rainy and dry seasons	- case studies and field sampling
		- animal	- production/animal	
			- % of animals with body condition > 3 (scale 1-3) in dry season	- case studies and field sampling
			- calving rate	- case studies and field sampling
		- other commercial products	- quantity/quality produced: e.g., timber, fruits, environmental services	- case studies and field sampling
	Management	- pasture management	- area of pastures burnt	- case studies and field sampling
			- frequency of burning	- case studies and field sampling
			-% of farmers burning pastures	- interviews with farmers and records
			- % farmers applying herbicides	- interviews with farmers and records
			- % farmers practicing manual weed control	- interviews with farmers and records
			- no. pasture divisions	- case studies
		- animal	- amount of supplements	- case studies and farm records

		management	fed/farm in the dry season	
			- amount of tree foliage/pods or fruits fed/animal	- case studies and farm records
			-% farmers feeding forage to match nutritional requirements of animals	- case studies and farm records
		- tree management	% farmers practicing silvicultural management of trees	- case studies, farm records and field sampling
	Economic	- economic performance	- gross and net margin of farms	- case studies, data collection and analysis
			- rate of recovery of credits	- analysis of farm records and reports of credit organisations
			- Increase of fixed capital/ha	- farm survey and records
			- % distribution of income- livestock, timber, other sources	- farm records and case studies
			- area of land purchased	- interviews with farmers
	Social	- labour used	- no. work days contracted/ha	- farm survey, farm records, case studies and interviews
			- salary of field workers	- farm survey, farm records, case studies and interviews
			- no. field workers contracted in dry and wet seasons	- farm survey, farm records, case studies and interviews
			- % distribution of work days in different farm activities	- farm survey, farm records, case studies and interviews
		- gender involvement	- no. hours/days, women involved in farm activities (milking, feeding, managing micro-livestock,, marketing, other)	- farm survey, farm records, case studies and interviews
			- remuneration of women (rate/hour)	- farm survey, farm records, case studies and interviews
			- no. hours/day women worked in activities outside of farm	- farm survey, farm records, case studies and interviews
Community	**Biophysical**	- land cover	-% forest cover: primary, secondary forest, silvopastoral systems, other	- satellite images, GIS maps and ground truthing
			- % area of degraded pastures	- satellite images, GIS maps, ground truthing and field sampling
			- % area under improved and natural pastures	- satellite images, GIS maps, ground truthing and field sampling
			- % increase in forest	- satellite images, GIS maps

			cover in fragile areas or hot spots	and ground truthing
		- biodiversity	- area of forest cover	- satellite images, GIS maps, ground truthing and field sampling
			- area planted with native species	- satellite images, GIS maps, ground truthing and field sampling
			- connectivity of forest cover	- satellite images, GIS maps, ground truthing and field sampling
			- area of forest and pasture burnt	-- satellite images, GIS maps, ground truthing and field sampling
		- cattle population	- cattle density	- farm survey and data base of farmer's organisation
	Socio-economic	- land tenure	- no. of farmers with land titles	- farm survey, data base of municipalities
		- migration	- no. of farmers migrating to agricultural frontier	- farm surveys
		- financial health of target group	- rate of recovery of credits	- farm records; reports and data base of credit institutions
		- poverty	- income/capita in pilot areas/target zone	- surveys
			- value of fixed capital acquired by landless poor	- surveys, case studies
			- no. of rural poor employed on livestock farms.	- farm records and surveys
			- no. of rural poor involved in processing and marketing of farm products	- surveys and records
			- no. of landless poor renting land from livestock farmers	- surveys
		- access to market	% farmers/price range of products	- interviews with farmers, records and data bases
			- number of commercial buyers	- interviews with farmers
		- financial input services	- number of centres providing services	- surveys
Community	**Institutional**	- institutional development	-% of active farm families in farmer field schools	- evaluation of participants in groups; analysis of records
			- no. of pedagogic tools validated in farmer field school	- analysis of records, data base and reports
			- no. of institutions involved in implementation of technologies	- surveys and interviews
			- no. of active	- records and data bases

			institutional cooperative agreement, programs, commissions and networks related to sustainable animal husbandry land management	
			- no of resolutions implemented related to sustainable animal husbandry and land management	- records and minutes of meetings, interviews
		- gender	- no. of active women groups	- survey and interviews
			- no. of women trained in aspects related to sustainable animal husbandry and land management	- data base and reports
			- quality of products and services offered by women groups	- interviews with clients, sampling,
	Legal political framework	- political will	- no of co-operative agreements signed related to sustainable animal husbandry and land management	- records, documents
			- no. of projects formulated for sustainable animal husbandry and land management	- records, documents
		- political action	- laws and regulations proposed in relation to sustainable animal husbandry and land management	- records, documents
	Municipal plans on natural resources	- political will	- no. of proposals submitted	- records and reports
			- no of persons involved	- records and reports
		- technical capacity	- no. of municipal personnel applying techniques and tools developed	- records, data bases, reports and interviews
			- application of monitoring and evaluation tool	- records, data bases, reports and interviews
			- use of data base created	- records, data bases, reports and interviews
			- change or modification of laws/regulation	- records and documents
		- action	- incentive schemes to promote sustainable	- documents, agreements, reports and interviews with

			animal husbandry and land management	stakeholders
			- institutional changes	- reports and interviews
			- no. of field actions	- records and data bases

Annex 2. Criteria used for selecting pilot areas*

- Livestock production is a dominant land use and pasture degradation induced by livestock activities is a major problem in the area
- Potential for conservation of biodiversity
- National and international priorities
- Accessibility/security
- Existence of a critical mass of local projects/institutions/organizations that have activities related to the recovery of degraded pastures, but avoiding excessive overlaps with the new proposal project.
- Existence of relevant information and opportunities to continue and take advantage of existing activities
- Potential for extrapolation (representativity) to the principal ecological areas in Central America where pasture degradation is a problem
- Importance: micro-watershed/municipal level
- Areas of approximately 70 – 100 km^2
- Predominant farm size of 35 – 150 ha (this does not exclude farms less than 35 ha).
- Receptivity and interest of communal and local authorities
- Complementary of characteristics to other pilot areas (ecosystems and livestock production systems) to insure inclusion of examples of principal livestock zones found in Central America
- Potential to achieve local impact (improve biophysical and socio-economic conditions)
- Complementary interventions of other institutions/organisations (e.g., improvement in land tenure policies, credits, improved conditions for marketing)
- Minimum risk of livestock expansion to agricultural frontiers
- Land use capability
- Pilot areas where cattle farmers have began to improve land use
- Resident farmers.
- Potential for organisation of women groups
- Potential impacts on rural poor
- Good markets for farm products (livestock, agricultural and forest products).

*Note that no one area will completely satisfy this check list- the intention is to choose areas whose characteristics are as close as possible to this list and where maximum impact/demonstration can be achieved with limited resources.

Annex 3. Summary of base line information on pilot areas

The baseline study, was carried out in the pilot areas selected for the project: Muy Muy-Rio Blanco (Matagalpa, Nicaragua); Juncal- Aguan River (Olanchito, Honduras); and El Chal-Dolares (Peten, Guatemala). Pilot areas were selected according to the criteria (**Annex 2**) agreed with stakeholders. Local experts contracted by CATIE, worked with farmers and local organisations in the pilot areas to ascertain their knowledge and perceptions of pastureland degradation. They also collected secondary information related to biophysical, social, economic and political conditions in each of the pilot areas.

Biophysical

Area and systems. Livestock production is the principal activity in the selected pilot areas; 95% of interviewed farmers depended on livestock production as a principal source of income. The Muy Muy pilot area corresponds to "sub-humid tropical forest in transition" with a dry season between the months of January and May. It covers an area of 110 km^2 with 220 cattle farmers. Juncal is classified as "humid tropical forest" and has an extension of 100 km^2 with an estimated 210 cattle farmers. El Chal-Dolares is also classified as "humid tropical forest" with an extension of 200 km^2 and 280 cattle farmers.

Land use. More than 75% of agricultural land in Muy Muy and El Chal-Dolares is under pastures where as in Juncal it is 56%. A relatively larger percentage of land is under secondary forest in Juncal (18%) and El-Chal Dolares (12%) compared to Muy Muy where it is only 4%. Agricultural crops represent 11% of land in Muy Muy, 18% in Juncal and only 3% in El Chal-Dolares. In Muy Muy and Juncal, cattle farmers (> 40%) are renting land to rural poor (land and landless) for the cultivation of subsistence crops (e.g., beans and maize). Farmers practice slash and burn of secondary forest for crop cultivation, which results in environmental degradation. Analysis of land use dynamics with farmers showed that the period for regrowth of secondary forest or fallows has decreased over the last decade (e.g., from 6 - 10 to 3 – 5 years) and that this is linked to pasture degradation. The decrease in the period under secondary forest regrowth is related to: i) increased population; ii) decreased farm productivity; and iii) progressive increase in the area of degraded pastures on farms.

Many cattle farmers have maintained or increased animal production by mining natural resources; e.g., through deforestation of secondary forest and/or purchase of land from poor farmers for pasture expansion. This problem is more evident in Juncal and El Chal-Dolares. Annual conversion rates of secondary forest to pastures are about 1% in Muy Muy, 5% in Juncal and 14% in El Chal-Dolares. Between 1999 and 2000, 20% of farmers in Muy Muy and 50% in Juncal purchased land for pasture expansion. Many farms in Juncal were ruined by Mitch and farmers received "post-Mitch" incentives to purchase land. In the three pilot areas, population has been increasing and the demand for land has resulted in an increase in land prices. This has had the indirect positive effect that cattle farmers can no longer depend on expanding production by purchasing cheap land. There is now a greater interest in adopting sustainable technologies and farm diversification.

Pasture degradation. In all pilot areas, a large percentage of pastures (35 to 50%) are on undulating land. In Juncal, 49% of pastures are found on severely eroded sites compared to 18% in Muy Muy and 1% in El Chal-Dolares. Pasture degradation is a major problem in the three pilot areas; more than 80% of pastures in Muy-Muy and 50% in Juncal and El Chal are moderately to severely degraded. The carrying capacities of these pastures are only 0.6 to 0.8 animals/ha which is far inferior to well managed improved pasture (1.6 – 2 animals/ha). The percentage of desirable grass species and ground cover of pastures are the main criteria farmers used to evaluate a pasture and to make a decision to abandon a degraded pasture. In Muy Muy, only 34% of the pastures have a vegetative cover of more than 50% of the soil indicating that degradation and erosion are major problems. Pastures are usually abandoned when the percentage of desirable species is below 40%. The bio-physical analyses showed that improved pastures usually degrade between 5 to 7 years. Degradation is linked with: 1) establishment of pastures on fragile land (e.g., hillsides); 2) overgrazing in the dry season; 3) frequent prolonged dry seasons; 4) burning of pastures; and 5) nutrient depletion. The average annual rate of pasture renovation is 5%, which is well below the estimated annual rate of degradation of 12%. This explains the progressive increase in the area of degraded pastures.

Cattle are undernourished as is shown by low milk yields (average 3 to 4.5 liters/cow/day). In Juncal, only 4% of farmers are providing the basic nutritional requirements of cattle compared to 30% in Muy Muy and El Chal. Nutritional deficiency is more severe in the dry season, which results in overgrazing of pasture and heavy soil erosion, the latter occurring especially at the beginning of the rainy season.

Regional environment degradation. The main negative effects of the agricultural and livestock activity on natural resources are soil erosion and a reduction in forest cover on the agricultural frontier, both at a regional and a national level. There is a migratory pressure on forest reserves close to all three pilot areas i.e., on the Bosawas, Pico Bonito and Maya Biosphere national natural reserves, in Nicaragua, Honduras and Guatemala, respectively. If ways could be found to develop sustainable land use for farmers in these pilot areas, deforestation in the adjacent reserves could be reduced.

Socio-economic

Culture. The local technical culture, as in other agricultural frontier zones, is principally extensive production based on abundance of land. Local cattle producers in particular have paid little attention to maintaining soil fertility and assuring forage supplies for times of scarcity. The moderate level of technological improvements in livestock production systems are based on cattle management, better infrastructure, use of veterinary products, establishment of improved grass monocultures, adoption of dairy breeds and the use of agro-industrial sub-products as cattle feed, but very little investment has been made to manage soil fertility and diversify farms to optimize land use. Small and medium sized livestock farm families as well as livestock dependent landless rural poor, should be assisted to develop non-degradative farming practices. In all pilot areas, there is a good supply of labour except in Juncal where labour can be scarce during harvesting periods of banana and oil palm. However, with the chronic coffee crisis, it is

anticipated that a diversified livestock industry will help to absorb labour displaced from the coffee industry.

Poverty. Cattle owners are not generally the rural poor. The very poor rural families in the study areas are landless livestock dependent people who do not own cattle. In the three pilot areas, about 70% of the population live in extreme poverty whereas the average at the national level varies between 10 to 20%. Only 10 to 20% of livestock farmers live below the poverty line. The majority of the poorest rural families are landless but they have some dependence on livestock farms. Traditional livestock systems are not very labor intensive (2 or 3 field workers/farm). More than 50% of the livestock farmers surveyed rent land to landless poor for the cultivation of subsistence crops (maize and beans). The surveys showed that there is a tendency for rural poor (landless and with land) to migrate to the agricultural frontiers; e.g., 15 cases were recorded in Muy Muy between 2000 and 2001. Reducing risk and mitigating its effect on poor livestock-dependent people are prerequisites for a sustainable reduction in poverty. Small and medium scale livestock production is associated with a mixture of both production and market risk. The promotion of diversified land use systems can help to stop resource degradation and hence reduce production risks of small and medium sized cattle farmers, as well as the landless poor who cultivate parts of the livestock farms.

Gender and farm families. In all pilot areas, it appears that women in livestock farm families have a better situation compared to women in families that produce subsistence crops and/or are landless. In Muy Muy and Juncal, 15 to 18% of women are involved in milking cows and cheese processing. A larger percentage of women (> 50%) in livestock farm families are involved in the management of small livestock, including pigs and poultry, that are important sources of protein for home consumption, and a source of capital for generating income in difficult times; e.g., sickness, purchasing of school books and uniforms. There is a good potential to improve productivity of small livestock with simple management practices; e.g., selection of good genetic stock and improvement of animal health and feeding practices. Although there are no registered women groups in the pilot areas, it was concluded that women groups can be organized to produce and process farm products to achieve added value.

More than 90% of small and medium livestock farm families live and work on their farms and there is a greater family integration in farm activities compared to larger farms that are managed by an administrator. In the latter case, the owners are involved in other business and do not reside on-farm. On average (70-80% of farms), livestock farms in Juncal and Muy Muy have 2.5 hired farm labourers; in El Chal, where cattle production system are oriented to beef and have a lower demand for labour, only 45% of farms employ this number of labourers.

7.3. Institutions

Development interventions in the livestock sector have generally not been successful from the point of view of sustainable farming. Inappropriate technologies and the failure to deliver services to poor farmers have contributed greatly to the lack of success of many livestock development projects.

Extension services. The extension services in the pilot areas are very limited in terms of the critical mass of extensionists and technical areas covered. In Muy Muy, more than 70% of farmers have access to extension services compared to 7% in Juncal and El Chal-Dolares. In Muy Muy, NITLAPAN is providing technical services to farmers and CATIE is providing training to NITLAPAN staff for subjects such as sustainable animal husbandry. CETA (Centre For Formation Of Technicians) is also involved in training technicians in this zone; currently graduating an average of 35 students per year of which more than 35% are women who are residents in the pilot area. The CETA program promotes the involvement of youths in farm production activities, and the understanding of the production cycles, in order to develop practical skills. CETA is located in a very strategic area in Muy Muy; their staff and students should be trained to monitor and evaluate the impacts of pasture degradation and recovery. CETA has good infrastructure for the organisation of training programs for extensionists and farmers. The focus should be on developing the capacity of farmers to evaluate, analyse and make rational decisions on the management of degraded lands.

Research. The main national institutions working in research on pasture and livestock production are INTA in Nicaragua, DICTA in Honduras and ICTA in Guatemala. These institutions have a narrow focus with respect to management of livestock systems and there are no discussions between local entities and these national research centres to define priorities for different eco-regions. Most of the pasture work involves validating the potential of novel forage grass species for pasture improvement but experience shows that these grass monocultures under traditional management also degrade in time. Development of sustainable livestock systems requires an integrated approach and should include training of technicians from the research institutions. The preparation of human capital to modernize the livestock sector has not been adequately dealt with and this should be a priority.

In Nicaragua and Honduras, the CIAT-Hillsides project is validating forage systems with farmers using a participatory approach. In Muy Muy, CATIE has been collaborating with UCA, UNA and NITLAPAN to evaluate multipurpose trees and the establishment of timber trees in pasture. CATIE and UCA are collaborating in the GEF-silvopastoril project for environmental services.

Credits. In general there is little investment in the farms because of inadequate cash flow and a lack of incentives. In the three pilot areas there has been a drastic reduction in the amount of credits offered in the agricultural sector because of privatization of services and closure of development state banks. Farmers access to credits is 48.3% in Muy Muy, 41.7% in Juncal and 11.9% in El Chal-Dolares. "Post-Mitch" development programs, which included credits for farmers, were set up in Juncal and Muy Muy; this explains the larger percentage of credits in these zones. In El Chal-Dolares, BANRURAL offers credit to livestock farmers for the modernization of the livestock sector. In Juncal, the principal source of credits is FONAPROVI (Fondo nacional para la producción y vivienda) which manages funds for the reconstruction of farms. In Muy Muy, FDL (Fondo Desarrollo Local) has been providing credit to livestock farmers; it has a solid capital and excellent recovery rate (97%). CATIE has provided training and technical assistance to experts of FDL who are developing credit mechanisms to promote diversified and sustainable livestock production systems. There are good examples in Muy Muy and Matiguas where farmers have obtained credit from FDL to establish multistrata silvopastoral systems. The project should promote similar credit models in Honduras and Guatemala.

Market institutions and infrastructure. More than 50% of farms in the three pilot areas have good year round accessibility which reduces costs for transporting farm products and inputs, and the cost of technical and credit services. Farmers in Muy Muy and Juncal benefited from the post-Mitch reconstruction of highway and road networks. In Guatemala, a highway was constructed linking the Peten to Guatemala City and Mexico. This has permitted the Peten to export beef to Mexico. In Muy Muy and Juncal, there are acceptable markets for milk products. Most farmers supply liquid milk to LEYDE in Juncal and to PARMALAT and PROLACSA in Muy Muy. Medium and large scale farmers sell milk to industrial plants because they receive premiums for milk quality. However, small farmers are often marketing milk to artesian cheese cooperatives because many small farmers do not comply with hygienic and quality standards set by industrial plants. In Nicaragua and Honduras, there is a market for local cheese to El Salvador but this market is unstable because cooperatives are not reaching Salvadorian quality and hygiene standards. Technical assistance to milk cooperatives to improve quality is needed. In Nicaragua, there are good examples where livestock farmers are producing and marketing timber because of increasing markets and prices for timber. Agro-industrial integration can provide stable markets and incentives for farmers to produce. Dairy and beef prices are increasing and this trend should continue over the next 3 to 5 years.

National policies. In all the pilot areas and target countries, policies have not been formulated and/or implemented for sustainable land use; e.g., to reduce deforestation, migration to agricultural frontiers, reduce burning of pastures, conservation of fragile areas and protection of rivers. There are no incentive schemes to promote the conversion of traditional livestock to diversified sustainable livestock systems, which is critical to reduce pasture degradation and migration to agricultural frontiers. In Honduras, FENAGH (National Federation of Agricultural and Livestock Farmers) have represented the interests of large cattle ranchers who have benefited from government incentive schemes; large farmers have purchased land from small farmers who are migrating to agricultural frontiers where land is cheaper (Kaimowitz, 2000). In Juncal, lands of many farmers along the river bank were washed away during "Mitch" and many of these farmers have moved to the hillsides to practice extensive grazing.

In the three countries, policy makers have recognized the need to promote policies to reduce deforestation. In Nicaragua, the Ministry of Agriculture started a program for productive re-conversion of ecosystems. In all three countries, the Ministries of Environment have started to develop GIS tools to monitor changes in the forest cover and migratory pressure on forest reserves. In Guatemala a program was started to gave land titles in Peten.