Management, Conservation and Utilization of the Pacific Chongón-Colonche Mountains in Ecuador: Project Methodologies and First Experiences

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Abstract

The Ecuadorian-German ODA project managed by *Fundación Natura* (an Ecuadorian NGO) and *GFA Terra Systems* (a German consulting firm) started in 1998 with a budget of € 9,5 million for a period of 10 years to promote local farmers in their efforts to reforest, protect and utilize the Chongón-Colonche forest in the North of Guayaquil. First results show the process of species and agroforestry systems selection, yield predictions deduced from actual growth of local plantations, financial incentive schemes, and proposals for Natural Forest Management and a M & E System. This highly complex project requires a constant effort of accompanying research.

Keywords: Forest Conservation Management, Agroforestry, Incentive Systems, Social Forestry, Prosopis juliflora

Problem Addressed

The Chongón-Colonche mountains at the Pacific Coast of Ecuador are situated north of the city of Guayaquil. The population of mainly red Indian origin live in the foothills of the mountains that serve important functions as a watershed for the dry coastal area, as a conservation area of endemic species and to provide the people with wood and many non-wood products. The constant fogs formed by the contact of humid tropical air with the relatively cold ocean water, are caught by the tree crowns. This mechanism of virtually "milking the clouds" is an important water providing mechanism for the mountain rivers. In the last decades the forest area has been reduced drastically due to a constant growth of the native farmer communities, that in fact own the forest grounds, immi-

gration of cattle breeders from the Manabí area and destructive exploitation by timber merchants. In 1994, with the help of the NGO Fundación Natura and some of the local villages, an area of 78.000 ha has been declared as "Protection Forest". This is a low conservation category of the National Forestry Law, that excludes forest logging but permits a non destructive use of the forests. In October 1998 an Ecuadorian-German ODA development project managed by Fundación Natura & GFA Terra Systems started with an overall budget of € 9,5 million for a period of 10 years to promote local people in their efforts to reforest, protect and utilize the Chongón-Colonche forest.

Objectives of Research

In order to reach its development goals, many questions have to be investigated by project accompanying research efforts, e.g. to

- Find effective mechanisms of financial or other incentives to get local farmers involved in restoring and conserving their forests
- Find land use systems (Afforestation, Agroforestry, Natural Forest Management) that conserve the environment and that are profitable and sustainable
- Find techniques to establish land use rights on the ground.

Research hypothesis

- Direct economic benefits are an effective way to get local farmers to participate in environmentally oriented projects
- Land use systems that are adopted by farmers have to fulfil a couple of well selected criteria
- It is possible to apply a natural forest management system that is attractive for the local people and conserves their forests.

Methodology and Work Plan

Since its start in October 1998, the project has elaborated forestry and agroforestry systems in a participatory process with the local people. A financial incentive system is in place that follows the successful experiences of GFA-Agrar in other countries (Kapp 1999). In the two years

ahead the currently rudimentary project data base will be developed and integrated in an overall Monitoring & Evaluation (M & E) System. Additionally a natural forest management system will be designed and incorporated. With the use of GIS and GPS the community land limits will be established on maps and in the field.

Preliminary Results and Perspectives

Since its start in October 1998, the project has achieved some results in community reforestations in the buffer zone of the Protection Forest, in land surveying, and in planning incentive tools for activities inside the Protection Forest.

Species Selection

The success of reforestation depends to a large degree on the "right" choice of the forestry or agroforestry systems and the species utilized therein. The selection process concentrated on the woody species components taking into account that local farmers know the agricultural plants or animals much better than the trees to be introduced. The following selection criteria and methods were used:

- Farmers preferences for some woody perennials
- Growth data from existing plantations in the area
- Existing markets for timber & non-timber products and price levels
- Personal knowledge and literature about species performance under similar climatic and soil conditions (Carlowitz et al. 1991).

Due to local topography (50 – 830 m a.s.l.) and the mechanism of shading and precipitation through the costal fogs, the mesoclimate is quite variable. Three climate zones are recognized: Semiarid (N = 250-500 mm), subhumid (N = 500-1000 mm) and humid (N = 1000-2000 mm) for which the following species were selected, after a thorough process of consultation with village groups and knowledgeable individuals on the local, administrative, scientific and commercial level (Table 1).

Table 1: Woody Species (exotics marked with *) used in the Reforestation Programme. Growth refers to some remnant plantations in the area. The timber value is the price local enterprises pay for standing trees. Ni = no information.

SPECIES	GROWTH ($m^3\ ha^{-1}\ a^{-1}$)	VALUE (€ m^{-3})	UTILITIES
*Azadirachta indica**	ni	ni	Carpentry, insecticide
Bambusa sp.	ni	ni	Carpentry, house walls
Calophyllum sp.	ni	ni	Carpentry, furniture
Carapa guianensis	1,8 - 2,2	13 - 15	Furniture, construction
Cedrela odorata	2,0 - 7,8	15 - 19	Furniture
Cordia alliodora	1,3 – 2,1	10 - 14	Furniture
*Leucaena leucocephala**	ni	ni	Firewood, fodder, nectar
Ocotea sp.	ni	ni	Carpentry, construction
Prosopis juliflora	ni	ni	Firewood, construction, fodder, nectar
Pseudosamanea guachapele	2,0 – 3,8	ni	Furniture, carpentry
Schizolobium parahybum	ni	ni	Pulp wood, pallets
Sorocea sarcocarpa	ni	ni	Furniture, construction
Swietenia macrophylla	ni	ni	Furniture
Tabebuia sp.	0,4	19	Construction, parquet
*Tamarindus indica**	ni	ni	Fruits, construction
*Tectona grandis**	1,9 –2,6	37	Furniture, carpentry, handicraft
Triplaris cumingiana	ni	10 - 15	Furniture, construction, firewood
Vitex gigantea	ni	ni	Construction, furniture

The reported growth figures were derived from sample measurements in existing plantations of the area. Tree growth is generally very low compared to data from other countries (e.g. for *Cedrela odorata*, *Cordia alliodora* or *Tectona grandis*, Kapp 1998) and highly variable. This may be explained through the general precipitation deficit in conjunction with the prevailing shallow unfertile soils and a heterogeneous topography. The local prices for standing timber are moderate, but should be considered in relation with the extremely low day wages for rural workers of € 1,5.

Reforestation Systems in the Buffer Zone

Up to now the following forestry and agroforestry systems have been established on a total of 295 ha of plantations and 33,5 km of tree lines (Table 2). About 12 communities, 5 farmer associations or committees and some private farmers have been involved.

Table 2. Forestry and Agroforestry Systems utilized by the Project up to June 2000.

SYSTEM	ESPECIES	SPACING & DENSITY	YEARS OF INCENTIVE	ACTUAL AREA	INCEN-TIVE (€)
Open Field Timber Tree Plantation	Mostly *S. parahybum, C. odorata, C. alliodora, S. macrophylla*	4 x 5 m 500 trees ha^{-1}	5	120,7 ha	135
Open Field Multipurpose Tree Plantation	Species for fuelwood, fodder or nectar, like: *P. juliflora, L. leucocephala*	4 x 5 m 500 trees ha^{-1}	3	145,9 ha	107
Timber Tree Line	*T. grandis, C. alliodora, C. odorata, V. gigantea*	2,5 m 400 trees km^{-1}	3	33,5 km	75
Bamboo Plantation	*Bambusa sp.*	5 x 5 m 400 plants ha^{-1}	3	28,8 ha	53

The relatively large reforestation area with meliferous and fodder producing species has its root in the development of bee keeping activities or silvopastoral systems in the area. Many houses and rural buildings are constructed with bamboo that is frequently split and used as a sort of board to build air permeable walls. This and the anti-erosion effect of bamboo along riversides explains the great interest in this reforestation system. It is common sense to associate the newly planted trees with agricultural crops like coffee, citrus, papaya, plantain, sweet potato (*Ipomea batatas*), pigeon pea (*Cajanus cajan*), maize, manioc or pineapple. Other drought resistant crops like sisal (*Agave sisalana*), pearl millet (*Pennisetum americanum*), sorghum (*Sorghum bicolour*) or cashew nut (*Anacardium occidentale*) were proposed by the project to be experimented on a small scale.

Incentives (for the woody component only) are paid partly in kind (seedlings) and partly in cash, spread over 3 to 5 years. Field inspections combined with extension work precede every payment. The farmers have to prove a minimum plant survival rate of 70% and follow an agreed list of maintenance work to be entitled to the incentives.

Management Systems inside the Protection Forest

Although the mentioned reforestation systems can be also applied inside the Protection Forests when using native species, some additional

measures were designed to improve the ecological and economic value of the forest (Table 3).

Table 3. Management Systems for the Protection Forest.

SYSTEM	SPECIES	SPACING & DENSITY	YEARS OF INCENTIVE	INCENTIVE (€)
Enrichment Planting	For example *C. odorata, Tabebuia sp., C. alliodora*	6 x 4 m 416 trees ha^{-1}	5	73
Palm Plantation under Natural Forest Shelter	*Phytelephas macrocarpa*	10 x 10 m 100 palms ha^{-1}	5	42
Live Fences for Boundary Marking	Tree or shrub species	6 m 167 trees km^{-1}	4	72
Palm Plantation	*Carludovica palmata*	3 x 3 m 1111 palms ha^{-1}	2	141

These Management Systems have not been applied yet. The nuts of *Phytelephas macrocarpa* yield the famous "plant ivory" that is sold on the national and international markets. The leaf fibres of *Carludovica palmata* are locally elaborated and sold to produce the well known "Panama hats" and other handicraft objects.
Other sustainable silvicultural systems for timber and non-timber products are under study and will be introduced in 2001.

Delimitation of the Protected Forest Area

A practical problem of great importance is the delimitation of the borders of the Protection Forest and between the communities. Although in the various decrees the borders are described with topographic instructions, these were neither marked on official maps nor on the ground. Some of the places in the Protection Forest are today completely deprived of their forest vegetation, whereas some villages like to see other areas included. The marking of some 200-300 km of borderlines in the field has to be the starting point for the planned forest management and protection. However this is likely to create conflicts between the different villages among themselves and with the State Authority. The overcome these difficulties, the project has started with a participatory land survey approach. A Global Positioning System (GPS - a Magellan PROMARK X CM) with a Differential Beacon Receiver and the software MSTAR was

purchased and a land survey course was given for projects technicians and representatives of eight communities. The agreed border line will be entered in a GIS for area calculations and to produce thematic working maps, documents and specific data for M & E.

Monitoring & Evaluation of Activities and Results

The successful management of this complex project with hundreds of clients and thousands of payments and field checks requires a powerful physical and financial M & E System. The structure of the first part, concerning plantations, was elaborated in a MS-Access data base. It has four interrelated sections, where the data are entered continuously (Table 4).

Table 4. Plantation Data Base of the Project with its four Sections. DBH = stem diameter at breast heigt

PLOTS	INSPECTION	INTERVENTIONS	DATA TAKING
Location: general site No., district, community, site, lot No., owner, lot seize, plot No., plot seize, GPS coordinates	*Location*: general site No.	*Location*: general site No.	*Location*: general site No., sample line No., orientation of sample line
Site characteristic: climate, slope orientation, soil type, former land use	*Inspection*: date, person in charge	*Characteristics*: weeding type, pruning type, thinning type, plant protection treatments, general actions	*Time of measurements*: Date of data taking
Dates: planting, replanting	*Results*: percentage of surviving plants, phytopathology situation, general problems	*Time of interventions*: weeding date, pruning date, thinning date, plant protection treatment date, general actions date	*Specific data (repetitive)*: tree No., species, DBH, DBH2, DBH3, DBH4, DBH5, total height, commercial heigt
Species (repetitive): name, seed provenance, nursery, No. of plants, type of mix, planting material, spacing type, distance 1, distance 2, agricultural associations, replanting percentage	*Urgency of interventions*: plant protection, weeding, pruning, thinning, general interventions		

The Plantation Data Base provides the project management with the necessary information about tree performance, necessity of interventions and intervention execution control. A similar data base will be established for the natural forest management and both will be connected to a financial FoxPro data base.
Additional to the reforestation area indicators, the farmers economic benefits or the evolution of the vegetation cover in the Protected Forest area and its buffer zones will be monitored and evaluated.

Conclusions

Every project is an intervention for a specified period (in this case 10 years with 5 years of foreign aid) and with limited resources (a staff of 8 professionals and a budget of € 9,5 million). Sustainable results can only be expected if a change of attitudes of a sufficient number of farmers can be achieved and/or if innovations are incorporated in their local economy. Sustainable land use is related to the ownership of the land and to the capability to make a living from it. Both factors will be improved through the projects activities, i.e. through land survey, reforestation with fast growing and valuable species and natural forest management. Severe risks to reach the project goals are seen in the general national economic deterioration in Ecuador, the fast population growth and severe climatic variations like the "El Niño" phenomenon with prolonged draughts and floods.

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