

Incentives for community reforestation in Colombia

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The Colombian Green Plan (CGP) has as a target to establish 100.000 hectares of forests from 1999 to 2002, the most ambitious program of its kind ever executed in the country. The CGP is being mainly financed with regional resources (those belonging to the regional environmental authorities) . It is basically a continuation of a Program developed during the period 1994-1999 that was mainly financed by the National Government based on international credits provided by the World Bank and the Inter-American Development Bank. Through the last one -the IBRD-IDB Program- 41.000 hectares were reforested. Both programs are community centered and use economic incentives to foster watershed reforestation. And both programs utilize financing

sources generated by economic instruments that exist in Colombia in order to finance the regional environmental authorities' investments.

The IBRD-IDB Program and the CGP have as main objectives to improve the supply of environmental goods and services, to offset the effects of degradation processes, and to improve the quality of life of the communities. In particular, they have been guided by the priority of protecting watersheds that are associated to the provision of water to the municipalities, using reforestation as main strategy.

This paper will make an approach to the evaluation of the IBRD-IDB program and the new Green Plan, in particular: (a) their environmental, social and economic benefits; (b) the use of economic incentives as main mechanism to foster reforestation; (c) the use of economic instruments as main mechanism to generate domestic sources devoted to the programs. In doing so, it will examine the assumptions on the environmental externalities of reforestation on which the two programs are grounded. And it will also examine the long-term stability of these programs, mainly in relation to its financing, market and management dimensions.

1. BACKGROUND

Approximately half the country is covered by woodland, some 50,000,000 hectares.

The higher levels of human intervention in the Andean and Caribbean regions have resulted in only a very low proportion of the natural forests that once existed there being preserved: the figures are 30% and 10%, respectively. This is in marked contrast to the forests of Amazon and the Pacific, where approximately 65% and 75%, respectively, have been preserved. The situation is particularly complex in the case of Andean forests, since recent research has shown that this is the part of the country which is the richest of all in terms of biodiversity, a clear indication of the extent of the threat to species and ecosystems (Instituto Von Humboldt, 1998).

1.1. Deforestation and reforestation

A major controversy is currently raging about deforestation statistics in Colombia over the last twenty years, and also about the extent of woodland cover and the make-up of this. During the sixties and seventies, the deforestation rate rose to 600,000 hectares a year (INDERENA, 1974). A rate of some 820,000 hectares per year was given in 1980, while the figure for 1989 was 650,000 hectares a year (Myers, 1989). FAO has placed the current deforestation figure at 262,000 hectares per year (FAO, 1997). The National Institute for Environmental Studies (IDEAM) has stated that there is no negative variation in the vegetation cover, but rather, quite the contrary, that there is a positive variation because much secondary forest has been recovered, notably in Amazonia. The institute quantified changes in vegetation cover between 1986 and 1996 on the basis of an interpretation and comparison of satellite pictures. From these maps, "it has been calculated that during the decade analyzed, the country lost approximately 145,000 hectares of forest and recovered about 3,445,000 hectares in secondary woodland cover. It therefore recorded a net gain in woodland cover of 3,300,000 hectares in ten years, some

330,000 hectares per year” (Sánchez, J., p. 295, 1998).¹ It also states that large-scale deforestation seems not to be taking place as it did in the sixties, seventies and eighties. Deforestation appears to be going on within the agricultural frontier.

Forests planted for commercial purposes amount to only 300,000 hectares. Timber exploitation is carried out to a large extent in natural forests throughout the country. Some 90,000 hectares were exploited during 1995 and 1996. This forestry activity is not sufficient to meet domestic demand, and the country is accordingly a net importer of timber (Sánchez, J., 1998).

Colombia has had a weak tradition in carrying out reforestation activities. Several factors have contributed to this absence of a “reforestation culture” in the country. The most important of these is the fact that the timber sector has found it more profitable to obtain permits and concessions for exploiting natural forests than to develop forest plantations. Another factor that has had a bearing is the high rate of illegal exploitation of natural forests. Due to lack of enforcement of forestry regulations these illicit activities are much more attractive and lucrative than developing plantations. Nor has commercial reforestation been adequately promoted and encouraged in the country, and the organizations that are responsible for forest administration have failed to allocate sufficient funds to protective reforestation or to develop a sustainable forest management of the natural ecosystems. This situation is very similar to the case of the other Latin-American tropical countries.

1.2. Watershed reforestation programs

The Colombian government has gradually been promoting a number of actions that seek to reverse the trends towards deforestation and create a reforestation culture in the country. During the last twenty five years the environmental authorities and other governmental agencies have developed different programs oriented to establish community based forests plantations in order to protect watersheds, located mainly in the Andean region that has been widely deforested. More recently, 1994, the Colombian Government created a program oriented to promote the establishment of commercial plantations based upon an incentive designed following the Chilean experience.

The major reforestation initiatives oriented to protect the watersheds have been: the Integrated Watershed Protection Program (PRIDECU)² the Rural Integrated Development Fund (DRI), the Magdalena Upland Watershed Program (PROCAM), and the Rubber Initiative of the Colombian Institute of Agrarian Reform and the IBRD-IDB Natural Resources Program. The last one achieved a reforestation of 40.140 hectares, during its five years of life, a figure never carried out by any other program even during longer periods of time.

¹ The authors make it clear that their comparisons relate to “large areas, based on satellite pictures, analysed on the large scale of 1:500,000”, and that these figures should be viewed cautiously, not only because of the degree of resolution at which the work was done but also because of the lack of any intensive verification work in the field. They also stress that the maps, idem pages 295-299.

² Siglas for Colombian or Latinaamerican institutions are in Spanish. Siglas for international institutions are in English.

As it could be seen in table 1, 15.000 thousand hectares were reforested out of the economic resources generated by provisions of Law 56 of 1981. According to them, Electric Companies had to devote 2% of the energy gross selling value to reforestation and other activities in those watershed areas where the hydroelectric dams are located. It was a provision based on the need of reducing sedimentation in order to protect hydroelectric dams, and assuring a regular water provision to these facilities. Other 2% had to be devoted to programs of rural electrification.

Law 56 was reformed in 1993 by means of Law 99 of 1993 that created the Ministry of the Environment. According to it Electricity Companies which generate hydroelectric power and have an installed capacity of more than 10, 000 kilowatts must transfer 3% of gross electricity sales to Regional Autonomous Corporations (CARs) and 3% to the towns where the watersheds related to the hydroelectric projects and the reservoir are situated. CARs, the regional environmental authorities, should devote these resources to protecting watersheds, while town funds should be used for improving the environment and for basic health. In the case of thermo-electric plants, the sum transferred is 4%, which is distributed as follows: 2,5% for the CARs and 1,5% for the towns where the generating plant is situated (Rodríguez y Uribe, 1996). It should be pointed out that Colombia relies mainly on hydroelectric power that represents 80% of the total electricity generated.

According to the Colombian Association of Electric Energy Generators, the electric system transferred COL\$95.585 millions to CARs from 1997 to 1999.

Table 1: REFORESTED AREAS IN DIFFERENT GOVERNMENTAL PROGRAMS: 1976-1999

<i>PROGRAM</i>	<i>PERIOD</i>	<i>YEARS</i>	<i>REFORESTED AREA (Has)</i>
<i>PRIDECU</i>	1976-1994	10	8.000
<i>PROCAM</i>	1979-1988	10	591
<i>DRI</i>	1976-1997	22	8.513
<i>LAW 56/81</i>	1981-1993	13	15.000
<i>PACOFOR</i>	1996-1997	12	664
<i>FEDERACAFE-KFW</i>	1993-1998	6	4.982
<i>F.R</i>	1994-1997	4	1.742
<i>ECOCARBÓN</i>	1993-1997	5	2.414
<i>IRDB-IDB</i>	1995-1999*	5	40.140

* December 1999

Source:

The Integrated Watershed Protection Program (PRIDECU) was a major precedent for the community based reforestation programs and for the inception of economic incentives for reforestation. The now-defunct National Institute for Natural Resources and the Environment (INDERENA, replaced by the Ministry of the Environment) carried it out between 1976 and 1992. Even though the coverage achieved by that program was small, some of its working modalities with communities would be guidance to other programs including the IBRD-IDB one. PRIDECU offered to small and medium farmers the opportunity to go into a business jointly with INDERENA. They provided the land and INDERENA provided technical assistance

and paid to the community for each planted tree and for each tree that survived during the first years of the plantation. Once the plantation was exploited the earnings were distributed 50% to INDERENA and 50% to the community. An evaluation carried out in 1987 -when finished the Canadian international cooperation program that fostered it- contained very mixed conclusion on PRIDEUCU successes and failures but advised its continuation. Plantation activities were realized up to 1994 when Inderena was closed. 126 communities participated in the program (Carrizosa, 1996).

In 1998 a PRIDEUCU project from the Santander Department and the governmental officer that promoted it were awarded with the National Environmental Prize as recognition of its environmental and communal achievements. It is today a 2000 hectares pinus patula commercial plantation located in a soil that had previously been impoverished by an erosion process. Actually this plantation is in the exploitation stage. But this one has faced some problems due to the fact that the community had not had an adequate preparation for the commercialization process. The difficulties are also explained by the death of the promoter that was a charismatic governmental officer that maintained a strong leadership on the management of the project.³

PRIDEUCU was never considered as a priority instrument for environmental or employment purposes because since its inception faced ideological obstacles on the left and the right. "Due to PRIDEUCU communal orientation some functionaries considered it a leftist and politically dangerous a fact that prevented to many high officers to support it. Paradoxically the more orthodox left did not either accept the project considering it was paternalistic and reformist. Only a bunch of public officers moved by idealistic or bureaucratic motives devoted to PRIDEUCU special efforts." (Carrizosa, p. 131)

2. INCENTIVES FOR WATER-SHED PROTECTION THROUGH REFORESTATION

The Ministry of the Environment synthesized the objectives pursued by the IRBF-IDB program in its final report on the program (MMA, 2001):

"i) To improve life quality of rural communities through the management and more suitable use of soils, vegetal cover and other natural resources, under strict sustainable criteria and giving priority to those areas affected by erosion problems and water supply deficits; (ii) to strengthen regional and local institutional capacity of those agencies belonging to the National Environmental System in relation to environmental management and participatory planning of micro-watersheds; (iii) to foster local communities participation and commitment in these processes, in particular in the case of micro-watersheds that supply water to urban and rural aqueducts."

Two facts should be stressed:

-An economic incentive to the communities acted as main propeller for implementing the program.

³ Personal communication with the Director of the Santander Autonomous Regional Corporation that is today responsible of following up this program.

-Reforestation was privileged as main watershed management practice. It focused mainly in protective and protective-productive reforestation that taken together represents 70.5% of the intervened total area.

2.1. The watershed approach

The BID-BIRF Program and the Green Plan are developed within the framework of the watershed management approach. A watershed is a topographically delineated area delimited by a stream system (i.e., the total land area above some point of a stream river that drains past that point) The watershed is used as a physical-biological unit and a socio-economic-political unit for the planning and management of natural resources. A river basin is similarly defined but is larger (the Amazon Basin, The Magdalena River Basin.) And the micro-watershed that is the unit used by the IBRD-IDB program is a watershed sub-system.

Watershed management is the process of guiding and organizing the uses of land and other resources on a watershed to provide desired goods and services for the satisfaction of human needs, trying to conserve or enhance water and soil resources and biodiversity. The concept recognizes the complex interlinkages among land use, biodiversity, soil and water and the linkages between the uplands and downstream areas. Watershed management practices are changes in land use, vegetative cover, and other actions that are taken in order to rehabilitate degraded lands; to protect soil and water systems for land being managed to produce food, fiber, forage, and other products of the land; and enhancement of water quantity and quality or of other environmental goods and services such as biodiversity and carbon sequestration (Brooks, Gregersen, et al; 1992).

A watershed management approach has traditionally incorporated soil and water, conservation and land use planning into a broader framework, focusing on the following concepts: (i) People are positively and negatively affected by the interaction of water with other resources, and, in turn, people influence the nature and severity of such interactions by the ways in which they use the resources. (ii) The effects of these interactions follow watershed boundaries, not political-administrative boundaries; thus what is done in the highlands of one political-administrative unit -country, community, farm- can affect another political unit occupying a downstream position in the watershed. (iii) Because such interactions across political boundaries, what may be a sound use of resources from the point of view of a political unit may not be a sound use of resources from a broader, societal point of view, because of undesirable downstream effects, or what economics denominate externalities; this approach bring such externalities into the analysis by considering watershed boundaries.

In the last years, biodiversity, carbon sequestration and recreational values have been incorporated along with water and soil in the watershed management approach.

As it has been pointed out "The integrated concepts of watershed management provide a framework for sustainable development, whereas watershed management practices provide the tools for making the framework operational" (Brooks, Gregersen, et al; 1992; page 458).

2.2. Economic incentives, watershed protection and poverty alleviation

The economic incentive for planting protective and protective-productive forests in the IBRD-IDB program was mainly targeted to small farmers, as a mean of poverty alleviation. Similarly, besides its environmental objectives the Green Plan pursues to contribute to reduce rural poverty, a target that seems more urgent now than when was launched the IBRD-IDB Program as long as the country has recently reached one of the highest unemployment rates of its history.

Most of the countries of Latin America are implementing economic instruments as a complement or substitute to the traditional command and control instruments that have dominated environmental management, a tendency as well observed in other regions of the world. Many countries are using renewable natural resources charges, contamination charges, tradable emission permits, taxes, etc. A great effort has been done to adapt these instrument to the regional realities, a fact contrary to the common affirmation that have been imported from the industrialized countries without any scrutiny. The introduction of these instruments is associated to the new conceptions on environmental management and the economic policies that have aroused within the free trade context. It assumes that it is necessary to evolve from a coercive (or police) centered environmental management to a situation in which the environment is protected by means of the market forces. The economic instruments had been used without too much success in the region since the seventies and a new generation of instruments has been implemented since the beginning of the nineties. During the first years of this new wave, it was assumed that implementing economic instruments was a less demanding task than implementing command and control instruments in relation to financing and personnel resources requirements. However, experience has shown that economic instruments demand strong institutions for its formulation and implementation (CEPAL, 1998; World Bank, 1996; Rodríguez et al., 1996).

Economic incentives for reforestation have been the focus of a long controversy mainly in relation to those oriented to commercial plantations. During the last two decades, the predominant academic view -on line with the no-liberal economic policies- has considered that incentives are not the most efficient way of promoting commercial plantations. According to it there are other vehicles for launching high levels of investment in this area, mainly of macroeconomic, political and institutional nature. It should be created an investment climate without the support of subsidies that favors a thriving private entrepreneurial sector. Similar views have been put forward in the case of exploiting natural forests (Haltia and Keipi, 1997; UNDP, 1996).

However, an increasing number of policy makers and academics are today arguing in favor of targeted forest incentives. This tendency seems a consequence of the generalized failure in achieving sustainable forest management and the increasing forest degradation, particularly in the tropical countries, during the last decade. Destruction of natural forest continues and environmental unfriendly logging seems the predominant practice of forestry in natural as well as in natural forests (GEO, 2000).

For many developing countries the need of incentives is justified on the fact that as general rule of thumb, Western investment in forestry has shown a strong preference for plantations and timberland investment, mainly focused in a few low risk countries. A search on this area demonstrated that private sector has little appetite for investment in countries that are not in the lowest 15 or 20 on investment risk scales; its preferences are focused in plantations in a small

number of countries, particularly in Australia, New Zealand, and, possibly in Chile (Moura-Costa, 2001).

Different South American countries are implementing programs to foster commercial forest plantations based upon economic incentives. They seem to have been motivated by the very well known Chilean experience. It is estimated that during the twenty years the Chilean forestry promotion law was in force, the State invested US\$140 million in incentives for afforestation and management something that catalyzed private investment amounting to more than US\$4.000 million in afforestation, management and industry (Raga, 2001). Some of the governments that have created incentives -e.g.: Argentina, Uruguay, Colombia- seems to have concluded that the very impressive Chilean achievement of planting near one million hectares was a direct consequence of economic incentives. However, this policy motivation is not on line with different studies on the Chilean case that have concluded that incentive was a minor factor contributing to forest industry growth once a critical mass of plantations was on place (Beattie, 1995) or that had only a secondary role in fostering plantations (Wunder, 1994). Contastino (1995) showed convincingly that forest development in Chile was the result of a cluster of factors, including political and macroeconomic stability, guaranteed private property, trade liberalization, good natural conditions, stable "rules of the game", government credibility, etc. In other words, incentives by themselves might not be successful, a situation that has happened in some Latin -American countries in the past (CEPAL, 1997)

More important, the arguments in favor of targeted incentives arises out from the factor that, in general, market seems to favor forest destruction and degradation. Gergessen and Contreras (2001) have stressed that for the big and medium private entrepreneurs, as well for the small rural farmer, the best business is to exploit forests in a non -sustainable way. Sustainable forest management is a term that belongs more to the rhetorical realm than to the actual forestry practice. With this affirmation we are not dismissing the valuable achievements reached throughout very much advertised instruments, as it is the case of forest certification, but we are recognizing its very limited scope and impact.

The use of incentives for forestry seems increasingly compelling as a compensation for positive externalities or, in other words, payment for environmental services that are not recognized by the market, in particular: biodiversity conservation, hydrological regulation, carbon sequestration, landscape aesthetic values, recreation, etc (Richards, 1999; WCFSD, 1997). But economic theory stresses that incentives will only be effective if the externalities are relevant enough to guarantee a change in the land use pattern driven by the entrepreneurial sector or the traditional forest inhabitants.

Often these incentives have the potential to bring social benefits in rural areas with high poverty rates and environmental degradation, a major factor that should be taken into consideration; but the potential cost effectiveness of forestation programs in alleviating rural poverty should be examined in comparison to other alternatives (Vaughan, 1995).

Considering forests within the watershed framework, it is affirmed that given the existence of externalities, ecologically sound management becomes good economics for all concerned only if the costs and benefits are appropriately distributed among the political units, communities and individuals that carry out watershed management practices and those that benefit of them. (Brooks, Gregersen, et al; 199; Chandrasekharan, 1996). And it is prescribed that to achieve a

sound incentive design is necessary to quantify those externalities. However, quantification of most of these externalities seems very far away of day to day policy making. An the last contention could lead us in many circumstances to the need of using the precautionary principle as the only guidance for establishing incentives based on not solid economic-quantitative grounds, a position very much outside economic orthodox and traditional policy making.

3. IMPLEMENTATION OF THE IBRD-IDB PROGRAM

The economic incentives for microwatershed projects were implemented through the contribution of three financing sources: (i) IRDB and IDB credit resources; (ii) implementing agencies form resources coming of the national budget, the Royalties National Fund or their own rescues; (iii) communities (represented in kind). These incentives were oriented to small and medium farmers, as long as for the large ones exist a particular incentive -CIF-, see table 2.

Taken together the IBRD-IDB Program and the Green Plan have represented the main strategy for fostering reforestation based on economic incentives realized in Colombia during the last ten years. Table 2 synthesizes the other incentives for reforestation existing in Colombia.

Table 2

FOREST INCENTIVE CERTIFY (CIF): PLANTATIONS	
Legal Instrument	Law No. 139, 1994
Type	Financial economic: direct
Financing sources	National budget, Internal and international credits
Objectives	To promote commercial reforestation; to diminish pressure on the natural forest
Amount	A fixed amount per hectare, established annually by the Ministry of Agriculture. It recognizes 75% (natives species) and 50% (introduced species) of net costs of planting; 50% of net costs of maintenance from the first to the fifth year. It also recognizes the maintenance costs of natural forests within the Forestry Management Plan that should be submitted for the incentive approbation
Allocation mechanisms	FINAGRO (a financing public agency for the agriculture sector) and the National Federation of Coffee Growers
FOREST INCENTIVE CERTIFY (CIF): CONSERVATION	
Legal Instrument	Law 223, 1993
Type	Financial economic: direct

Objectives	To compensate land owners in relation to the maintenance direct or indirect costs of natural forests in good state of conservation
Financing sources	National budget, Internal and international credit, international cooperation
Amount	Seven minimum daily salaries per month per hectare that could be adjusted according to the regional characteristics
MAGDALENA RIVER FOREST PROGRAM: CIF-KFW	
Legal Instrument	Law No. 139, 1994; Forests Action Plan for Colombia
Type	Financial economic: direct
Objectives	Soil erosion reduction; hydrological regulation; wood provision for different uses
Financing sources	Government of Germany (KFW):CIF financing direct costs); indirect costs are financed by the implementing agencies, among them National Federation of Coffee Growers and the Regional Coffee Growers Committees
Amount	The same as CIF for plantations

Communities of farmers (small and medium farmers) are fostered by the implementing agencies (mainly CARs) to plant trees in their lands based upon an economic incentive, technical plans and required professional and technical assistance. Through a contract CARs provide an incentive equivalent to 80% of the economic resources that are necessary for the plantation and maintenance of the forest. The community contributes in kind (labor) up to an equivalent of 20% of planting and maintenance costs. The projects co-financed by IRDB worked with the scheme 80-20 during the complete period of the program. The IDB component started with a different scheme but since 1997 adopted the 80-20 one.

The implementing agencies contracts with communities of small and medium farmers reached approximately to an investment of COL\$ 42'775. 000 from 1994 to 1999. It is equivalent to a US \$37.86 millions: US \$16.66 millions from credit resources (US \$8.65 IRDB and US \$8.01 BID)⁴, US\$10.75 millions provided by the implementing agencies and US\$10.45 by the communities (represented in labor) as shown in table 3.

Investment during the period included: the establishment of 40.140 hectares of vegetal cover by means of different systems, the maintenance of 32.257 48.245 hectares, and the building up of biomechanical works in approximately 5.000 hectares, as well as the technical assistance and the community promotion required by the program.

The program supported maintenance activities during three years (the year of planting, the second and third year). The program has committed resources for maintenance of 48.245 hectares previously established.

Table 3

IBRD-IDB MICROWATERSHED PROGRAM 1.994 – 1.999. COFINANCING COMPOSITION (COL\$)⁵				
RESOURCE TYPE	CREDIT	OPERATOR (mainly regional corporations)	COMMUNITY	TOTAL
IRDB	10.049.599.567	7.926.694.006	4.323.311.986	22.299.605.599
IDB	8.749.452.637	4.205.112.222	7.520.481.377	20.475.046.237
TOTAL	18.799.052.205	12.131.806.228	11.843.793.363	42.774.651.796

The program has developed activities in 341 micro-watersheds: 176 based upon IRDB resources and 165 with IDB resources.

These micro-watersheds are located in 23 departments and 254 municipalities distributed throughout all geographic Colombian regions; including "San Andres y Providencia" islands.

The Regional Autonomous Corporations (CARs) was the main implementing agencies. RACS are the regional environmental authorities and are responsible of implementing the environmental policies and programs formulated by the Ministry of the Environment. 27 out of the existing 33 RACS participated in the PARM. In addition 3 departments, 1 municipality and 7 ONGs participated as implementing agencies.

From these 38 operators, 29 co-financed projects with IDB resources, 21 with IRDB resources (9 operators were only IRDB and 17 only IDB), and 12 developed projects based upon both credits.

PARMN used seven basic systems for watershed protection: protective reforestation, protective-productive reforestation, reforestation for dendro-energy purposes (or fuel wood forests), establishment of agroforestry systems, establishment of silvicultural systems, establishment of hedgerows of planted trees, and restoration of areas through biomechanical works. According to the Ministry of the Environment "these systems have been agreed through a concerted process between the implementing agencies and the communities that live in the watershed area, taking into account each microwatershed particular problems. The main priorities have been to guarantee a permanent provision of water of good quality and to improve the communities quality of life based upon sustainable management of the plantations"

Protective-productive forests has been the main watershed management system implemented and represents 23.728 hectares, equivalent to 59.2% of the total area.

⁵ The exchange rates applied from 1994 to 1997 are those existing at the moment of realizing the payments: : Col \$/US \$) 1994: 850, 1995: 935, 1996: 1037, 1997: 1227.3, 1998: 1450, 1999: 1700.

Protective forests and fuel wood forests represent 11,3% and 10,0% respectively. Taken together, agroforestry and silvicultural system represent 13,5%. Hedgerows of planted tree reaches 2,5% (Table 4).

TABLA 4
SYSTEMS FOR WATERSHED PROTECTION

TYPE OF FOREST	AREA (Has)	% TOTAL AREA
<i>PROTECTIVE-PRODUCTIVE</i>	23.728	59,2
<i>PROTECTIVE</i>	4.553	11,3
<i>FUEL WOOD FORESTS</i>	4.032	10,0
<i>SILVICULTURAL SYSTEM</i>	2.660	6,6
<i>AGROFORESTRY SYSTEM</i>	2.618	6,5
<i>HEDGEROWS OF PLANTED TREES</i>	999	2,5
<i>OTHER ACTIVITIES</i> (e.g.: bio-mechanical works)	1.550	3,9
TOTAL	40.140	100

As indicated, the program has a wide national cover. However 67% of the intervened total area is located in the Andean region that is the most deforested region of the country.

111 out of the 131 (85%) tree species planted by the users of the program are natives. Natives species and exotic or introduced species cover 51% and 49%, respectively, of the total planted area, according to a sample realized on 26.769 hectares (or 67% of the planted area in 1999). The more used species are: *Eucaliptus grandis* (13.95%), *Pinus patula* (8.47%), *Cordia alliodora* (11.97%), *Guadua angustifolia* (9.59%) and *Tabebuia rosea* (6.15%). The first two are introduced or exotic species.

According to the Ministry of the Environment, the population benefited by the program reaches 20.000 farmers (owners or usufructuaries of the land where the intervention is developed), 581.000 direct beneficiaries (inhabitants from the zone) and approximately 3'600. 000 indirect beneficiaries (inhabitants belonging to the localities where are placed the aqueducts that take water from the microwatersheds). 360 aqueducts, including rural and municipal ones, are located in the intervention areas.

4. THE GREEN PLAN

The Green Plan is a continuation of the IBRD-IDB micro-watershed program. The Green Plan presents new emphasis and differences in comparison with the implemented IBRD-IDB Program as it appears in the official document elaborated by Ministry of the Environment.

Its target is more ambitious: 100.000 hectares from 1999 to 2002⁶

It is financed predominantly with domestic resources of regional origin

It is not only focused on protective-productive and protective reforestation as major strategies for the management of the micro-watersheds. Ecological restoration is pointed out as one of the Plan priorities. This is an approach that is focused on the restoration of one or more ecological features of a natural ecosystem (diversity, structure and ecological processes), including the ecological services rendered.⁷ There are three main activities in the ecological restoration component of the Green Plan: restoration of critical and strategic natural ecosystems, restoration of damaged mangrove swamps, and restoration of areas affected by forest fires.

Restoration of critical and strategic natural ecosystems starts from an acknowledgement of the fact that secondary forests which grow after human intervention has occurred can be managed in such a way that they will produce ecological and economic benefits that are similar to those attributed to primary forests. Secondary forests are important from the ecological point of view, amongst other reasons because they quickly accumulate a high volume of biomass, which means they become carbon reservoirs, and also because of the role they play in protecting hydrographic basins, regulating water flows, preserving soils, reducing erosion processes, restoring productivity in the soil so it can be used for agricultural purposes, and maintaining biodiversity and habitats. The most important economic benefits of secondary forests are their high productivity levels and their great potential for the exploitation of both timber and non-timber products.

Despite the importance of the ecological restoration of secondary forests and the management of successive vegetation in them, the Plan recognizes that there are factors in the country that limit the performing of these activities, due to research deficiencies in this field and the lack of experience.

In addition to ecological restoration the Plan envisages those systems for watershed protection that were as well incorporated in the IBRD-IDB Program: protective forests and protective-productive forests; reforestation for dendro-energy purposes (fuel wood); agroforestry systems; silvicultural systems, and hedgerows of planted trees.

Despite the formal objectives formulated by the National Environmental Authority, the implementing agencies seem mainly focused on reforestation for protective and protective-productive purposes.

⁶ The Green Plan established as target 160.000 hectares in its first formulation. See: Rodríguez Manuel and Eugenia Ponce De León. 2000. "La financiación del Plan Verde en Colombia: Retos y Oportunidades" en Fundación Alejandro Angel Escobar. 2000. *Restauración Ecológica y Reforestación*.

⁷ A workshop on ecological restoration was organized by the Ministry of the Environment an the National Environmental Forum. See: Fundación Alejandro Angel Escobar. 2000. *Restauración Ecológica y Reforestación*.

5. HYDROLOGICAL EXTERNALITIES AS MAJOR ENVIRONMENTAL BENEFITS

According to the Ministry of the Environment (IBRD-IDB Program Final Report): "the implementing agencies used the actual microwatershed water supply for human consumption as the decisive factor for project prioritization". It is a criteria that seems coherent to an affirmation of the same report: "During last years electric energy and water for human consumption has been rationed in many regions and sectors for long periods as a consequence of forest degradation". More specifically, it points out that deforestation has originated a major hydrological deregulation in the Magdalena river Basin where live more than 60% of the population and it is produced 80% of the PIB. According, to IDEAM -the Colombian Institute for Environmental and Hydrological Studies- the water level in the Magdalena river has increasingly been responding in a sharper way to seasonal changes (from dry to rainy, etc); but at the same time this Institute points out that there is not any research that have attempted to establish its causes in a systematic way.

This last view of the Ministry of the Environment, that relates forest degradation with periods of water scarcity in some Colombian regions, is widely shared by the Colombian public opinion. In a recent article the Colombian Ex-President Alfonso López Michelsen, a very well respected journalist and political thinker, pointed out that: "The illicit plantations have been an efficient cause of deforestation that along the future years will be translated in the definitive disappearing of river and streams that were our hydro proud" (López Michelsen, 2001)

Major assumptions on the relation between watershed forest cover and water quantity and quality are explicitly established in the IBRD-IDB Program Final Report:

- "Forests favor water infiltration and percolation to the underground allowing aquifers to recharge as well as the storage and permanent regulated provision of water to springs, rivers and streams. This sponge effect is better in watersheds covered by trees that by short natural vegetation or clean crops. In the last one, the superficial run-off is higher that infiltration and percolation generating streamfloods."

- "Forests are the vegetal formation that offer to soils the best defense against erosion. It has been observed that soil protection and water regulation is better in a natural forest that in planted forests, in an old forest that in a young one, and in dense forests that **in one that has been exploited**"

On the same token, the new Green Plan emphasizes the improvement of water quality and quantity and erosion reduction as the major environmental benefits expected from its watershed management strategy based mainly on reforestation:

- "Benefits related to the increasing dry season flows and regulation of flows during the year. These impacts have a positive incidence on water availability for provision of aqueducts for human consumption and for provision of irrigation systems and agricultural activities, mainly during summer seasons when water has a higher marginal utility"

"Soil loss rate reduction. This impact allows to diminish costs of water treatment processes for human consumption, and costs of maintenance and replacement of water treatment equipment, as well to increase hydroelectric reservoirs life that is limited by colmatage processes originated on sediment transport by water currents that fed them"

In contrast with the two last claims on the expected environmental benefits of the Green Plan, the state of knowledge on the hydrological impacts resulting from land use change points out that is not possible to assume that reforestation leads unambiguously to an improvement of water availability for provision of aqueducts or other human activities. And that is not possible to assume that reforestation will lead to a reduction of soil erosion of such magnitude -in terms of its impact on water treatment-, that will justify the economic investment on reforestation. This last contention fits in the context of the main conclusions reached by B. Aylward (2000) after an exhaustive review of both theory and empirical evidence related to these matters: "The general statement that forest provides soil and water conservation benefits, or watershed protection benefits, is disingenuous in implying unidirectional effects, i.e. only benefits."..... "It would be incorrect to assume that the hydrological externalities resulting from land use change are necessarily negative. As a result it may be time to reconsider the conventional wisdom that land use change away from natural vegetative states must always impair watershed protection values"

These conclusions embody a wide evidence on the linkages between forest cover and reforestation and soil erosion and sedimentation, seasonal flows, water yield, rain and floods that are synthesized in the following paragraphs.

Soil erosion and sedimentation. Empirical and theoretical research conclude: (i) erosion losses of soil from undisturbed tropical forests is low in comparison to other vegetal covers; (ii) reduction or conversion of watershed natural vegetation is likely to increase downstream sediment levels and lead to higher nutrient and chemical outflows, (Roberts, 1997). Empirical evidence supports as well the conventional wisdom that sedimentation will negatively affect hydroelectric dams, aqueducts, waterways, irrigation systems, and coastal zones. But at the same time, Ayrwald has concluded that in the case of hydroelectric dams the extent of sedimentation and its economic costs may often be of limited consequence and that previous studies have tended to exaggerate them. And Kaimowitz has pointed out that nor Aylward or anyone else has seriously analyzed the possible economic costs of sedimentation on drinking water (Kaimowitz, 2000).

A range of activities related to reforestation and forestry can carry a risk of erosion. Such activities are cultivation, felling and timber extraction (Roberts, 1997). In the case of planting protective-productive forests that is the main strategy used by the Colombian Green Plan, there are not studies on their effects. The extent of erosion in these forests would come of the kind of practices used during management and exploitation of them. On the other hand, there have been both theoretical and empirical studies that conclude that some tree species can enhance erosive capacity of rainfall. Hall and Calder (1993) concluded that kinetic energies of drops falling from *Tectona Grandis* could be as much as nine times greater that form *Pinus Caribe*. However there are no guidelines based on structural or morphologic tree properties to predict species with some associated erosion hazard (Hall and Calder, 1993, cited by Roberts, 1997). It has been demonstrated that is advisable to promote a good understory to the planted forests where there is such risk of erosion (Roberts, 1997). But these under-stories can use substantial amounts of water and to remove them to increase water yield would be likely to be unacceptable from the ecological perspective.

Finally, Aylward (2000) concluded, "few of the empirical studies of sedimentation have also considered water quantity effects. In forest areas, land use change may lead to major changes in rates of evapotranspiration and so it would appear indispensable to combine both aspects into the analysis of externalities."

Given the increasing role of costly infrastructure works (reservoirs, aqueducts, irrigation channels) within overall water resources management, and the very real threat of their accelerated siltation, the study of the sources of eroded sediment and its movement through tropical river basins is becoming increasingly urgent. Without quantitative information on the temporal and spatial dynamics of erosion and sediment yield it is impossible to evaluate the need for, nor the effectiveness of, upland soil conservation programs (Van Dijk, 1998). However, in many fragile areas that have already lost their original forest cover, natural regeneration and fire control might well be the most cost-effective means of reducing sediment flows, but few watershed management projects have concentrated on those aspects (Kaimowitz, 2000).

Seasonal flows. Sustained dry season flows from forests is site specific (Roberts, 1997). Seasonal flows, in particular dry season baseflow, may increase or decrease depending on the net effect of changes in evapotranspiration and infiltration. "Forest clearing, if followed by land uses that prevent rainfall from percolating into the ground, may reduce dry-season water flows. But it is at least as plausible that it will have the opposite effect. One cannot assume that forest cover will always help to maintain the availability of water in the dry season and it is very risky to assume that planting trees in deforested areas will re-establish or improve dry season flows." (Kaimowitz, 2000) No one has evaluated the effects in the Colombian context. Groundwater recharge is generally affected in a similar fashion to seasonal flows.

Water yield. Water yield is inversely related to forest cover. In most cases forests use more water than short vegetation. However there are important exceptions such as cloud forests, old forests and perhaps deciduous forests. Tropical montane cloud forests (TMCFs) are unique ecosystems that capture (as yet unknown amounts of) additional moisture from the atmosphere by a process called 'cloud stripping'. In combination with their allegedly very low rates of water uptake from the soil, this renders TMCFs effective 'water producers'. Yet no one knows what will happen to downstream water yield after converting headwater cloud forests to other land use such as the cultivation of temperate vegetables or pasture. Similarly, it is not known how the hydrology of TMCF is affected indirectly by land-use changes in adjacent lowlands, e.g. by a lifting of the cloud condensation level due to a warming up of the air. (Cavelier, 1992; Roberts, 1997; Van Dijk, 1998)

Rain. There is still insufficient evidence to identify a strong link between planting forest with increased precipitation. It seems that any effect may be small one. But a small effect could be very substantive in water resources terms (Roberts, 1997).

Floods. The amount of flooding from intense and large storms is not likely to be substantively affected by land use patterns. In addition, as it was observed, the removal of tree cover tends to increase annual water yields, since more water evaporates from trees than from shorter crops (Calder, 1999, cited by Kaimowitz). On average, this leaves more water in the soils that can contribute to flooding. Nonetheless, these results hold mostly for smaller areas.

What do we know about the hydrological externalities from the IBRD-IDB Program? The Final Report emphasizes that is too early to evaluate the environmental benefits. And at the same time recognizes the lack of a scientific based system of evaluation of those benefits as one of the major failures of the Program and points out the purpose of having such kind of activity within the Green Plan. However, it mentions positive qualitative and quantitative assessments made by the communities that inhabit some of the microwatersheds where reforestation was realized during 1994, 1995.

In two workshops realized with different members of a beneficiary community from the Tolima Department pointed out that a reforestation realized in a particular micro-watershed have had a positive impact on water availability during the dry seasons. "This impact was evident because before starting the project, the community began to have problems of water provision from the stream: today the problem has disappeared. In the mentioned cases *Erythrina edulis* and *Trichantera gigantea* were planted."

Similar testimonies on the impacts on water availability were submitted in workshops realized in Nariño, in particular in relation to project in the Galeras Volcano skirts. "The annual average flow of the San Felipe stream increased from 8 liters/second to 12 liters second. The benefited community -that faced before water shortage problems-, attributes this increase to the reforestation project." "Inhibitions from the Florida municipality pointed out similar impacts in relation to the Pachindó stream as effect of the reforestation"

In conclusion, examining the IDB Program and the Green Plan, and its explicit priorities of guaranteeing water provision for human consumption, it should be stressed that it is not possible to generalize in relation to the sign of hydrological externalities that can result as a consequence of planting forests. A reforestation may lead to a decrease in sedimentation, subsequently causing water quality to improve. At the same time, however, the increase in forest cover may also lead to a decrease in water yield thereby decreasing water availability for aqueducts. Or planting trees in a deforested area may lead to an improvement in seasonal flows guaranteeing the provision of water to the during the dry season; however such an improvement could as well not happen. The existing knowledge doesn't shed too much light on the size of the economic externalities related to the water provision and the reduction of erosion, as a basis for justifying the investment incurred in reforestation.

6. INCENTIVE EVALUATION AND ALTERNATIVES TO REFORESTATION

A study was elaborated for the Ministry of the Environment in order to evaluate the justification and impact of the IBRD-IDB program's economic incentive in relation to the hydrological externalities derived of watershed protection. The study focused on hydrological regulation and erosion control as long as these are the central environmental benefits established by the Program. Its major assumptions are framed within the context of the conventional wisdom on reforestation and hydrological externalities. After a brief review on the theoretical and empirical evidence on forests and hydrology, it affirms that "the practical conclusion is that in order to achieve hydrological regulation is necessary to reforest". Four representative micro-watersheds of the IBRD-IDB Program located in different Colombian regions were studied based upon a theoretical evaluation. Cost-benefit relations of implementing reforestation incentives were

evaluated based upon the externalities accrued of changing total water yields and sediment production by means of new vegetal covers.

The evaluation concluded that the IBRD-IDB incentive exceeds the economic value of hydrological benefits, including erosion reduction. The economic benefits are generated by the improvement of water provision for human consumption and the social gains represented by agricultural activities. Based upon secondary information and extrapolation techniques the study did an exploration on the economic valuation of major benefits accrued to other environmental goods and services: carbon sequestration, private benefits received by the landowners where the reforestation is realized, social and recreational. It concluded that the addition of all these benefits exceed the incentive value of the IBRD-IDB program, or, in other words, that there is not a subsidy.

As suggested before, the hydrological and erosion models used in the evaluation lacks of firm scientific evidence about the positive direction and magnitude of the hydrological response that is assumed to occur following reforestation.⁸ Despite these limitations, a review of its recommendations is relevant as long as they convincingly suggest the need of including or intensifying other strategies different to reforestation in the Green Plan in order to change undesirable land use patterns (See Annex 1): sustainable integrated systems, sustainable crops cattle conversion, sustainable forests and "paramo" management and natural re-vegetating. However these recommendations do not make a due consideration of biodiversity benefits inherent to the IBRD-IDB Program and the Green Plan, in particular to those related to planting natives trees. Natural regeneration is the only exception to the last affirmation. It appears as a very sound alternative for watershed protection. Besides, it could bring positive impacts in terms of biodiversity conservation. In fact, natural regeneration is one of the ways that have been pointed out for ecosystems restoration that is one of the main objectives established by the Green Plan.

7. IBRD-IDB PROGRAM AND GREEN PLAN FINANCING INSTRUMENTS

As mentioned, the IBRD-IDB program financing was mainly based upon credits coming from these two institutions that are equivalent to 44% of the total resources invested (Table 1). The implementing agencies (mainly the CARs) provided 28,4% and the communities 27.6% (represented in labor). Regional Autonomous Corporations (CARs) co-financing came in some cases from its own funds (local origin) and in other from the national budget. The last cases correspond basically to those CARs that do not have substantial revenues of regional origin, a fact that has its explanation in the financial structure of the Colombian environmental sector.

Various sources of funds from public and private entities and civil society have been allocated to financing the Colombian Green Plan:

⁸ Two hydrological models (Curve Number from Soil Conservation Service and Alejandro Deeb's model) were used in order to determine the hydrological externalities, in particular in relation to water quantity. The Universal Equation of Soil Losses by Wischmeier and Smith was used in order to analyze sediment production.

Ministry of the Environment.

Regional Autonomous Corporations (CARs).

Great River Magdalena Corporation (CORMAGDALENA). This is an entity that was set up under the constitution and which is responsible for ensuring that the River Magdalena remains navigable and for protecting natural resources in 127 riverside towns; it is financed using funds from the National Royalties Fund (NRF).

National Royalties Fund

According to Table 5, CARs and National Royalty Fund have the major share. This is explained by the budgetary structure of the Colombian environmental sector, as described in the following section.

**TABLE 5: GREEN PLAN
SOURCES OF FINANCING (IN MILLIONS US DOLLARS, 2000).**

ENTITY	RESOURCE NATURE	TOTAL: 1999-2002	
		US Dollars (millions)	%
Ministry of the Environment	National	5.76	4.90
Regional Autonomous Corporations (CARs)	Regional	46.70	40.00
National Federation of Coffee Growers		3.80	3.30
Magdalena River Corporation	Regional	3.80	3.30
Community	Regional	23.50	20.00
Sub-total		83.56	71.50
National Royalty Fund	Regional	33.33	28.50
Total		116.89	100.0

The high share represented by regional revenue is due mainly to the provisions established in 1993⁹, which favors decentralization of environmental management. CARs are the major contributors (40%). It seeks to give greater autonomy and stability to regional environmental authorities and provides some resources to departments and municipalities. (The environmental authorities are in hierarchical order: Regional Autonomous Corporations -the principal implementing agencies of the national environmental policy-, departments and municipalities).

⁹ A Law in order to reform environmental institutions was approved in 1993.

The main sources of financing for the regional corporations are local, and this commits the regions to meeting present and future environmental funding demands and to taking a greater interest in seeing that funds are used well. These regional sources are many and varied: property taxes; electricity sector contributions; retributive, usage and compensatory rates; a percentage of the stamp tax on automobiles; fees for licenses, concessions and transportation licenses; and a percentage of the product of indemnities and fines for environmental damage (see Table 6).

However, 80% of the regional corporations' own funds currently come from two sources: a percentage on the property tax and transfers by the electricity sector, which is predominantly in private hands. Because of their origin, these two sources tend to be concentrated mainly in the richest parts of the country, and this result in an imbalance between these and the poorer areas in terms of funds available for environmental management. An attempt has been made to correct this problem by means of a compensation mechanism which directs 20% of income from the electricity sector into a general fund, from where it is redistributed amongst those corporations which do not benefit from this source. An attempt is also currently being made to favor the poorer regions through the National Royalties Fund.

The National Royalties Fund that was established in the 1991 Political Constitution collects the royalties coming from exploiting non-renewable natural resources. These resources are allocated to regional entities (departments and municipalities). Approximately 30% of its funds are allocated to environmental management activities, which are to be executed by the said regional entities (departments and towns) through projects which they submit to the Fund and needs a previous approbation by the Regional Autonomous Corporations and the Ministry of the Environment.

Income from electricity sector transfers, the property tax, and the National Royalties Fund (NRF) are much less subject to the ups and downs of the economy and the whims of politicians, since the latter two have their origin in the Constitution while the first was established by Law of the Republic. These provisions were established with a view to setting the funding of the environmental sector up on a sound footing. They try to prevent this funding from being dependent upon the priorities of the government of the day or any particular economic situation. The value of these provisions has been amply shown in the current economic crisis in the country. The actual fiscal deficit has led to the government to make drastic cuts in the budgets of various sectors, yet this has not affected the funds in question. Of course, the possibility always exists that this "shielding" of environmental sector revenue will be dismantled by means of an amendment to the Constitution (as with the NRF and the property tax percentage) or to the law (electricity sector transfers), which are channels that are somewhat complex. Between 1993 and 1998, Colombian public budget for the environment tripled in real terms, as a result of the new economic instruments for generating sources of income for environmental protection.¹⁰

In synthesis, the existing economic instruments oriented to generate financing resources to CARs and territorial entities guarantee a continuity to reforestation programs in Colombia. Many promising programs from the past (e.g. PRIDECU) faced enormous difficulties as consequence of lack of financial resources. It has been a disruptive factor that in many cases have made difficult or impossible to evaluate and to follow up those programs. The situation

¹⁰ The share the different sources represented in the total public investment for 1998 was as follows: national budget 18%, regional corporations' revenue 62%, National Royalties Fund 15%, and international technical cooperation 5% .

today seems different. All CARs that have revenues produced by economic instruments have been able to commit to the CGP. But its commitment has been motivated by their perception that the IBRD-IDB Program has been a successful endeavor and by the communities' demands of continuing the reforestation programs.

Table 6

ENVIRONMENTAL SECTOR REVENUE

<p>Property Tax Percentage. A percentage (between 15% and 25.6%) of the total property tax collected in towns is allocated to the Regional Autonomous Corporations (CARs).</p> <p>Electricity Sector Transfers. Companies which generate hydroelectric power and have an installed capacity of more than 10, 000 kilowatts transfer 6% of gross electricity sales - 3% to the CARs and 3% to the towns where the watersheds related to the hydroelectric projects and the reservoir are situated. CARs funds should be allocated to protecting watersheds, while town funds should be used for improving the environment and for basic health. In the case of thermo-electric plants, the sum transferred is 4%, which is distributed as follows: 2.5% for the RAC and 1.5% for the towns where the generating plant is situated. It should be pointed out that Colombia depends heavily from hydroelectric power (80%)</p> <p>National Royalties Fund (NRF). Approximately one third of royalties from the exploitation of oil, gas, coal and other mineral resources is allocated to the NRF. This in turn allocates one third of its funds to financing environmental protection projects that are carried out by regional entities (towns and departments) under RAC supervision. NRF, as well, allocates 10% of the royalties to the Magdalena River Corporation.</p> <p>Percentage of Stamp Tax on Motor Vehicles. Towns should transfer up to 10% of sums collected for this tax to the CARs</p> <p>Rates Deriving from the ‘Polluter Pays’ Principle. (i) Retributive and compensatory rates for direct or indirect use of the air, soil and water allocated to the CARs and the towns. (ii) Water usage and forest exploitation rates, allocated to the CARs.</p> <p>Percentage of Investment in Water-Related Projects. 1% of the investment in every project that involves using water from natural sources should be allocated by the party executing the project to protecting the respective hydrographic basin, in the form of projects, which are supervised by the CARs.</p> <p>Percentage of Regional Entity Budgets. Towns and departments should allocate 1% of their budgets for ten years from 1993 to purchasing land for protecting the hydrographic basins which stock town water supply systems.</p> <p>Indemnities, Fines and Penalties. 50% of the product of indemnities imposed in furtherance of actions by the people are allocated to the National Environmental Fund, and the remaining 50% to the CARs. 50% of the value of fines imposed by regional entities by way of penalties for breaking environmental rules or regulations are allocated to the CARs, and the remaining 50% to the regional entity that imposed the fine.</p> <p>National Environmental Fund. This is a financial mechanism that is administered by the Ministry of the Environment and which supports the execution of environmental policy by financing both NES public entity and NGO projects. The sources of its funding include the following: external loans, administration of the Parks System, external debt exchange for environmental activities or projects, 50% of indemnities imposed and collected under Article 88 of the National Constitution with respect to damage caused to the environment, donations or funds received under any title from national or foreign individuals or legal persons, and items assigned</p>
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under the national budget; also returns obtained on credits granted or on liquidity surpluses. The NEF includes the Amazon, Pro-Sierra Nevada de Santa Marta, and National Parks sub-accounts.

Source: Rodríguez and Uribe, 1996.

8. TWO CASE STUDIES

Jamundi IBRD-IDB Program for Watershed Protection (1994-1999) and Medellin Green Plan (2000-2004) provide two different examples of the Green Plan implementation. The Jamundi program is starting now a new phase within the Green Plan framework, being financed mainly by the Regional Autonomous Corporation of the Cauca River Valley (CVC), and keeping its main purposes and characteristics. The Medellin Green program was initiated in year 2000. Its main purpose is to establish productive forests in the hills around the Aburra Valley, where is located Medellin, the second city of Colombia.

8.1. Jamundi: IBRD-IDB Program and Green Plan

The IBRD-IDB Program was realized in the Claro, Timba and Jamundi microwatersheds from 1994 to 1999. Claro and Timba streams are tributaries of the Jamundi River. Actually the Green Plan is being implemented in the same area, as a continuation of the IBRD-IDB. Watershed protection related to the provision of water to the aqueducts and erosion reduction were established as main objective of the program since its launching.

The region is located on the skirts of the western mountain range at a height between 1200 and 1.800 meters up the sea level. It is relatively close to Cali, a Colombian city located in the Cauca Valley that is a very rich agricultural region dominated by sugar plantations. Black rural communities inhabit the Jamundi area where the Program is concentrated. Their livelihood is based on small coal mining exploitation and agricultural and cattle raising activities realized in small farms.

Cauca Valley Autonomous Corporation (CVC) is the implementing agency of IBRD-IDB Program and Green Plan. It achieved a target of 6000 hectares in the first program and has set 30.000 hectares for the Green Plan. Both are based upon the 80-20 system by means of which the implementing agency contributes with 80% of the plantation costs and the community contributes in kind (labor) with the remaining 20%. CVC is financing the Green Plan out of its won resources, a very different modality to that one of the IBRD-IDB Program based basically on resources coming from international credits executed under the Ministry of the Environment coordination.

CVC is one of the strongest regional environmental authorities of Colombia. Following the Tennessee Valley Authority model, CVC was created in 1944. From its foundation up to 1993,

CVC had a wide range of responsibilities including hydroelectricity generation and distribution, water regulation of the Cauca River, infrastructure development and administration and regulation of the renewable natural resources and the environment. On 1993, as a consequence of the new environmental law (Law 99, 1993) and the privatization policies, CVC sold its electricity facilities and specialized as regional environmental authority. CVC is one of the pioneer environmental authorities in Latin America. For example, in the seventies started to implement contamination charges to industry and in the eighties started a program for watershed protection based upon a compensation paid by the sugar can industries and big landowners ("hacendados") to the farmers located in the up-lands. Other example is the case of the sugar industry: the contamination load to the Cauca river has diminished 90% in a twenty years period. CVC is exceptionally financed. Out of the selling of its electricity properties, it has a patrimony of US\$350 millions and its proceeds should be devoted to investment projects for environmental protection. In addition, CVC receives significant proceeds coming mainly from the electricity transfers and the property taxes. The disposal of those financial sources has allowed to CVC to launch the most ambitious Green Plan at regional level

As main motivations for establishing the Jamundi program area are pointed out:

Poor vegetal cover in the Jamundi, Claro and Timba watersheds.

Increasing degradation of the remaining natural forest as consequence of a deforestation of 10 hectares per year realized by farmers in order to get levers for the mining activity, satisfy other domestic needs and provide timber for a furniture industry.

Existent land use conflict in relation to soils' forests vocation> According to CVC, 3.225 hectares are in very high land use conflict, 2356 hectares in high conflict and 1163 hectares in moderated conflict. "This situation has originated a hydrological deregulation and 2.8 tons per year sedimentation of infrastructures of the plane zone"

The process leading to identify the problems and priorities of the watershed included an analysis of existing studies on soil, water, vegetation cover, etc, taking into account the experts and community knowledge that is recovered through workshops, site visits and meetings. After this general diagnosis, a management plan was realized in agreement with the communities, including an identification and prioritization of the more relevant situations. A prioritization stage concluded that protection and restoration of Jamundi, Claro and Timba watersheds was the most urgent project.

The different stages are built by means of a community participatory approach that envisages different activities: home visits, meetings with potential project users, users pre-selection, induction workshops, users selection, operative plan design workshop, planning participatory work-shops, association and group organization, technical-social-entrepreneurial training, knowledge dialogues and field workshops for technology transference, leadership formation, and experts training.

Both programs -IBRD-IDB and Green Plan- cover 4 sub-municipal administrative units ("corregimientos" or corregidor zones) that include 56 small villages ("veredas"). Approximately 1.372 hectares were reforested through the IBRD-IDB program from 1995 to 1999. This reforestation is located in a basic nucleus and 571 families have participated directly in the project. The average farm has 5 hectares being 15 hectares the maximum size. The

Corporation designs jointly with a farmer a process to compensate for the reduction of production that could arise as consequence of taking away a portion of land for reforestation purposes. In the case of cattle raising it includes the plantation of fast growing leguminous that allow to maintain the same level of activity. In the case of agricultural farms, intensive agroforestry practices are introduced in the areas that are destined to these purposes. Alley cattle raising and cropping are a common compensation system. Crops or cattle are grown between hedgerows of planted trees and shrubs, preferably leguminous and fruits. The zones taken away, in order to introduce changes in the land cover use, are mainly planted with protective-productive forests. In the last case, only it is possible to plant 600 trees, a low density that is explained by the former cattle raising use. The farmers have preferred Eucaliptus-grandis because its potential usefulness as mining levers and other domestics purposes. The change from cattle raising has been favored by the farmers fears of being robbed by the guerillas and para-militars. Re-vegetation has been other practice used for changing land cover through mechanical isolation (fences).

CVC uses the 80-20% incentive scheme. Its contribution is represented in seeds, fertilizers and elements to control ants (a very common pest to reforestation in the area) as well as salary payments that represent approximately 65% of total investment. Communities contribute in kind (labor) up to an equivalent of 20% of the total investment. The same scheme (80-20) follows for maintenance purposes during the next two years after the year of tree planting. For implementing the IBRD-IDB program, CVC signed a common work contract at individual level. For the Green Plan this modality was changed to collective contracts signed by a representative of six farms. The contract contains the main activities that will be executed according to the Management Plan of the specific zone.

A very well qualified forestry engineer with a master degree on forests and hydrology was the coordinator of the IRDB program and he is now the director of the Green Plan. He devotes half of his time to this project. Six full time forest and agroforestry experts and two social workers provide technical assistance to the farmers and visit the zone every day. The experts implement a geo-referenced monitoring process focused on tree growth, mortality and three-health. Measurements are taken of sediment contribution. There is not an equivalent system on water quality and quantity. The project assumes that in ten years there will be positive impacts on dry season water provision, and on controlling floods during the rainy season.

Since the beginning, the Program has been able to deal with guerrilla and paramilitary groups that infest the Jamundi area. These groups do not have popular roots in the region, a common denominator to many Colombian zones where the armed conflict is present. This is the case of "Villa Colombia", the main program nucleus where up to now 600 hectares has been reforested and where 400 hectares will be reforested during 2001. The National Liberation Army (ELN) firstly dominated Villa Colombia but was substituted by the Colombian Armed Revolutionary Forces. The paramilitary group known as Colombia National Auto-defense Movement expelled the last guerrilla group. The CVC coordinator and experts, jointly with the community leaders, have been in need to explain and to try to convince to these groups on the program justification. In balance, it has been a successful work. However, CVC has not been allowed to implement the program in an area close to Villa Colombia where coke plantations are placed. And the more recent paramilitary presence has forced to some landowners to leave Villa Colombia. These absent farmers that now live in Cali are executing its duties with the project through paid workers.

The project users have stressed the main strengths of the Jamundí IBRD-IDB project in an evaluation workshop: (i) the project is well financed; (ii) an effective and efficient institutional support by CVC and Jamundi municipality; (iii) available lands for reforestation; (iv) improvement of family livelihood; (iv) users high motivation for implementing and continuing the project; (v) positive environmental, social and economic benefits. As main weaknesses are singled out: (i) lack of consolidation of users associations that the farmers consider as a key element for its implementation; (ii) difficulties in facing the ant plague that did a great damage to the tree plantations in its early stage; (iii) slow growth and development of the Cordia Eliodora tree specie (coffee walnut tree) as consequence of low soil fertility.

The CVC stresses as the project main impacts and attributes: (i) an increment of the forest cover in the microwatersheds; (ii) elimination of land use conflict in 1341 hectares; (iii) pressure reduction on the natural forests; (iv) soil erosion reduction; (v) creation of a new tree culture; (vi) increasing community receptivity of the program as expressed in the high number of new users applications for the Green Plan; (vi) strengthening and creation of social organizations around the project.

Both CVC and communities' existing evaluations have a qualitative bias. The quantitative evaluations stress the program efficiency in relation to its physical execution, general tree health and growth. Sedimentation measures indicate a soil erosion reduction.

The project assumes that in ten years there will be positive impacts on dry season water provision, and on controlling floods during the rainy season. However the Program Coordinator, a well-qualified professional, is aware of the problematic scientific basis for such an assumption. Recognizing the uncertainties associated to the assumed hydrological benefits, it seems urgent to establish a monitoring program that evaluates them.

It is perhaps related to these facts and the dynamic acquired by the program that the Coordinator affirms: "The IBRD-IDB Program started as an environmental project but today it is better described as a social-forestry program. The forestry-farmer is an innovation to the region". The social impact of the program has not been accurately measured and it seems a very difficult task to achieve. But it seems evident that it should have been a palliative to the community's hardship imposed by the armed conflict.

The continuation of the IBRD-IDB program through the Green Plan and the strong financial CVC situation is allowing the necessary continuity of the Jamundi reforestation in the long run. This is a major strength as long as many programs of its kind have often foundered as consequence of not being able to monitor the reforestation and to provide technical assistance to the communities trough the different stages that includes planting, maintaining and exploiting the forest and commercializing or industrializing the forests products.

However, the last aspect -the marketing side of the forest products- seems a very neglected field. CVC coordinator expressed concern on this matter: "The commercial aspect was not considered by the IBRD-IDB program. It is urgent to face it now that the firsts plantations, that go back to 1994, are producing their first benefits". The forest plantations initiated in 1994 are being pre-harvested for getting mining levers and some wood for domestic and commercial purposes. CVC has been the major buyer of logs for using them as fences in order to isolate areas for re-vegetation. But this special buyer can not be the basis for future developments. As the

coordinator added: "we have the duty of helping the communities to envisage and implement the best markets opportunities as well as the industrial and commercial strategies for the future"

8.2. Medellín Green Plan (2000-2002)

The "Medellin Hillside Plan", developed within the Green Plan framework, is a new project and not a continuation of the IBRD-IDB program. It has as main purposes: (i) to protect the hillsides around Medellín by means of planting commercial forests; and (ii) to provide recreational and aesthetic services to the Medellín population.

Medellin is the second Colombian City. With two millions inhabitants, it is located in the Aburra Valley crossed by the Medellín River. The Valley is surrounded by an impressive mountain range. Ten small towns share with Medellín the Aburra Valley.

40.000 thousand hectares of land located mainly in the hills of the surrounding mountains are targeted as possible areas for reforestation in the long term. 8000 hectares are targeted for the next three years. The landowners are inhabitants from Medellín or from neighboring small towns. Most of these farms are devoted to activities of a very low productivity (e.g. extensive cattle ranching). Some times are fully abandoned under the care of a steward that avoids its invasion. It is deforested with a poor pasture cover. All suffer erosion processes of different intensity. Many of these farms were thriving cattle raising and agricultural lands during the nineteenth century and first half of the twenty century. In many occasions they were productive-recreational farms where people from Medellín spent their weekends and long December vacations taking advantage of the milder temperatures and beautiful sights on the Aburra Valley.

The Aburra Valley and foothills have been intensively urbanized. Slums today occupy many environmental vulnerable sites. The rural area surrounding the urban settlements have become unsafe and is one of the reasons for the low productivity and abandonment of many farms. The rural area situation makes vulnerable to illegal urbanization of lands that border the urban centers, many of which are not adequate for urbanizing.

A contract is agreed between the implementing agency and the landowners. CORANTIOQUIA could act as implementing agency but this institution is able to transfer this responsibility to other agencies. Medellín Public Enterprise (MPE) was responsible of reforesting 3000 hectares during year 2000 that was the first year of the program implementation. The reforestation was carried out in 160 farms. *Pinus Patula* and *Eucaliptus Gradis* were the main species planted reaching a 1.100 trees per hectare density. In addition, it will be responsible of forests' maintenance for the next twenty years.

Neighbor communities to the plantation sites receive a contract for executing the reforestation. The community is represented by the local organization for community development. It is responsible for planting and maintaining the forests under the coordination of MPE special division of forestry. In many cases these communities live in Medellín City or in one of the ten urban centers involved in the Plan.

The percentage on the property tax -that by law receives Antioquia Regional Autonomous Corporation (CORANTIOQUIA- is the program main financial source. The net present value of the establishment and maintenance costs during the first two years is equal to US\$600 per hectare. Approximately 65% of this last amount are represented by labor costs or, in other words, the communities receive it. MPE, on behalf of CORANTIOQUIA will recover the investment and will share the profits (50-50%) with the landowner. The last one receives a land tax exception of 66% as an additional economic incentive during the project duration. The benefit that will receive CORANTIOQUIA and the landowners is estimated in US\$7 millions (net present value) on the 3000 hectares, taking a ten years horizon plan.

In addition, to the private benefits received by the project owners and the communities, the project brings environmental benefits. It is assumed that it is instrumental to reduce erosion not only as a consequence of the planted trees but as well as consequence of the under-story vegetation. However, there is not a monitoring system in order to measure this impact. The project constitutes a very pragmatic way of contributing to the enforcement of the Land Use Plans approved recently by the Medellin Council and the other Aburra municipalities councils. These Plans will be in force during the next nine years and they classify most of the land targeted for reforestation as not feasible of urbanizing. Finally, the Hillside Plan has recreational and esthetical benefits. It has been advertised as the ecological belt a denomination that the environmentalists do not welcome but that the urban inhabitants have received with enthusiasm.

9. FINAL CONSIDERATIONS AND CONCLUSIONS

"IBRD-IDB Program" and "Green Plan" are the result of a lengthy and gradual process on reforestation dating back to the mid seventies that includes the realization of four major programs. An important precedent was the community reforestation project for protecting watersheds (PRIDECU) which the environmental authorities carried out over the period 1974 - 1992.

The environmental authorities have set hydrological regulation and erosion reduction as major objectives of all these programs and reforestation as the main strategy for attaining them. In the case of IBRD-IDB Program and CGP these objectives have been related with the purpose of providing water to municipal aqueducts. However, an evaluation on their hydrological externalities, including erosion reduction, has not been carried out after twenty six years of experience. The need of realizing this kind of evaluation is a high priority as long as the common assumptions about a positive relation between reforestation and hydrological externalities are being challenged based upon theoretical and empirical evidence. It is clear that there are not grounds for assigning positive hydrological externalities to any protective-productive reforestation.

In synthesis, the IBRD-IDB Program and the Green Plan are based on a set of assumptions that seems to follow "the myths and misunderstandings that underlie a large portion of the popular thinking about the links between forest cover, sedimentation, rainfall, and water flows", for using an affirmation done by David Kaimowitz in relation to similar Central American

programs. But it should be recognized that these myths and misunderstandings have been instrumental to concentrate financial resources on an activity that it is strategic to create a forestry culture in many Colombian rural areas where environmental protection has been an elusive purpose.

Despite the lack of scientific evidence that supports the IDB-IBRD micro-watershed protection program (1994-1999), it seems to have generated social, economic and ecological benefits that the communities, local authorities, Regional Autonomous Corporations, and National Government perceive as positive. Otherwise it would be difficult to explain the perseverance of CARs on microwatershed reforestation by financing the Green Plan out of its own resources (It should be remembered that CARs have total autonomy from the national government on the destination of such resources). And it would be difficult to explain the community demands for continuing with the program. But to know what is the relative weight of each one of those perceived benefits do not seem feasible in view of the lack of information.

The social benefits accrued to the IBRD-IDB Program and now to the Green Plan seem in many cases (perhaps in most cases) very positive. It was mainly oriented to small and medium farmers located in rural areas affected by war or with a great potential of being involved in it. It is reasonable to assume that they have served as a palliative to poverty. This last role has probably been increased from 1998 to the present when the country has gone throughout a deep economic crisis, including a high unemployment rate. These kind of social benefits -not fully envisaged when the IBRD-IDB and Green Plans were formulated- have been very well illustrated through the Jamundi and Medellin program. The first one is being successfully realized in a war zone inhabited by poor black farmer communities. Similarly, the Medellin Green Program has benefited poor echelons from the city (some of them involved in complex processes of urban violence) through the provision of employment. These and other experiences provide elements for designing new programs that focuses reforestation and forest conservation as a substantive contribution to the peace process in different Colombian regions.

The economic incentive scheme used (80-20) has received a wide acceptance by the communities and seems very rooted in the regions where the program has been implemented. However the difficulties to establish and quantify the complete range of economic, social and ecological benefits makes illusory to attempt to estimate an optimum incentive. The difficulties inherent to estimate the hydrological externalities and the social benefits underlined in the last paragraphs point out the enormous difficulties of such attempt.

The regional origin and nature of the Green Plan financial resources not only guarantee that it will be carried out but could also enable it to continue in the long term. The Corporations have their own revenue that is generated by different economic instruments and is not subject to the whims of central government. On the same token, the National Royalties Fund enables the towns and departments to obtain funds for environmental management purposes, while Ministry of the Environment involvement ensures that these funds are used more effectively. The economic instruments for generating financial resources for environmental management are proving its justification though the reforestation programs. Being the last contention not very on line with the neo-liberal economic view that single out the inefficiencies that could arise of this kind of rent.

The new Green Plan involves some weaknesses and risks besides those formerly suggested. Although the restoration concept is a highly innovative component of the Green Plan, the limited

scientific and technical knowledge of the subject and the scant experience that are available mean that there will be restrictions and uncertainties when it comes to implementing it. Although there is wide experience in reforestation with native species, this has not been done in a very systematic manner, including the recent IDB-IBRD Program, and this renders the technical foundations for establishing the plantations weak from this point of view.

The Green Plan envisages research and monitoring being one of its critical components, but as it has been said, there is very little experience and 'tradition' in this field. One alternative that should be considered for overcoming this problem and building up national skills is inviting international organizations to take part in this process.

Annex

The Rural Studies Institute of Javeriana University realized the study "Review of the Economic Incentives Used in the Micro-watershed Projects" as a consultancy work made for the Ministry of the Environment and the National Planning Department. Its main purpose was to evaluate the justification and impact of the IBRD-IDB program's economic incentive in relation to the hydrological externalities derived of watershed protection. The study focused on hydrological regulation and erosion control as long as these are the central environmental benefits established by the Program. Its major assumptions are framed within the context of the conventional wisdom on reforestation and hydrological externalities. After a brief review on the theoretical and empirical evidence on forests and hydrology, it affirms that "the practical conclusion is that in order to achieve hydrological regulation is necessary to reafforest".

Four representative micro-watersheds of the IBRD-IDB Program located in different Colombian regions were studied based upon a theoretical evaluation. Two hydrological models (Curve Number from Soil Conservation Service and Alejandro Deeb's model) were used in order to determine the hydrological externalities, in particular in relation to water quantity. The Universal Equation of Soil Losses by Wischmeier and Smith was used in order to analyze sediment production. Cost-benefit relations of implementing reforestation incentives were evaluated based upon the externalities accrued of changing total water yields and sediment production by means of new vegetal covers. The evaluation concluded that the IBRD-IDB incentive exceeds the economic value of hydrological benefits, including erosion reduction. The economic benefits are generated by the improvement of water provision for human consumption and the social gains represented by agricultural activities. These benefits are accrued to increasing annual water yields, water dry seasons regulation and sediment reduction, all positive impacts coming from the new forest cover. In Table 8, column 1, last row (IBRD-IDB Program 80-20) we observe the actual value of the paid incentive (sub-row 1: Incentive) and the difference between the incentive and the benefits (sub-row 2: subsidy). In this particular case the subsidy is positive due that the incentive exceeds the value of the hydrological benefits.

Based upon secondary information and extrapolation techniques the study did an exploration on the economic valuation of major benefits accrued to other environmental goods and services: carbon sequestration, private benefits received by the landowners where the reforestation is realized, social and recreational. It concluded that the addition of all these benefits exceed the incentive value of the IBRD-IDB program, or, in other words, that there is not a subsidy (in column 4, last row (IBRD-IDB Program 80-20) appears the difference between incentive and total benefits; the parentheses indicate a negative quantity that means that benefits exceed the incentive).

The same study compared the actual strategies included in the BID-BIRF program -based mainly in protective-productive reforestation-, with other possible alternatives for increasing the vegetal cover and improving soil management in order to obtain similar results to those obtained with forest cover (Table 7). Besides promoting forest plantation it has proposed to introduce new agricultural practices that generate positive externalities or that diminish negative ones. The

proposal for implementing new activities for applying incentives is based upon the fact that "if it is true that in a wide set of micro-watersheds the actual forestry alternatives are viable and functional, in other micro-watersheds or taking into account other kind of producers within them, it is necessary to introduce new alternatives that satisfy the needs of potential incentive users, institutions and environmental problems that should be faced." (Page. 81)

TABLE 7: ALTERNATIVES FOR APPLYING INCENTIVES	
Actually implemented	New alternatives
<ol style="list-style-type: none"> 1. Protective forests and protective-productive forests 2. Dendro-energetic (wood-fuel) forests. 3. Silvopastoral systems (330 trees per hectare). 4. Agroforestry systems (330 trees per hectare). 5. Biomechanical works. 6. Natural revegetation. 	<ol style="list-style-type: none"> 1. Sustainable integrated systems 2. Sustainable crops. 3. Cattle conversion. 4. Natural re-vegetating. 5. Sustainable forests an "paramo" management.

Sustainable integrated systems are foreseen as an alternative that should not be promoted in all types of farms. The incentives would be oriented to small and medium farmers located in areas with environmental problems that require a priority attention but that are not in capacity of substituting its agricultural activity without placing their livelihoods in risk. So for example, in the Gold River watershed the alternatives to apply incentives are oriented to "an environmental conversion" of berry cultivation and pasture management. In some cases it implies to replace berries areas by a forest cover but in other cases it implies to introduce new technologies for cultivating them. On the same token, planted forests substitute pastures that are located in critic zones. And other pasture areas and cattle are managed through environmental sound techniques.

The sustainable crop alternative is oriented to a specific crop and not to a set of activities, as in the sustainable integrated system. Cattle ranching conversion is oriented to introduce adjustments in pasture disposition as well as in other vegetal cover and in cattle management; it has simultaneously three objectives: establishment of a more protective vegetal cover oriented to regulate run-offs and to diminish erosion through pasture densification, live fences, addition of leguminous fodder trees, shifting plots, etc; liberation of critic areas for natural regeneration or reforestation as long as increase cattle ranching efficiency; increasing of carrying capacity.

Natural regeneration should be promoted in degraded areas as well in key sectors for hydrologic purposes.

This study concluded that reforestation is not the most efficient way of obtaining the different environmental and social benefits pursued by the BID-BIRF program. As it could be observed (Table 8) the economic incentive used by this program exceeds to minimum incentives required by other environmentally equivalent alternatives: three integrated systems, cattle ranch conversion and natural regeneration.¹¹ However, the IBRD-IDB incentive for reforestation is

¹¹ Minimum incentive is defined as the addition (in net worth) of the annual amounts that compensate the difference between the alternative promoted by the incentive and the replaced activity. It takes twenty years as the planing horizon.

lower to that required for the sustainable crop alternative. And the minimum incentive required by the protective-productive forest, or that promoted by the IBRD-IDB program, is lower than the incentive actually recognized by it.

The study does not make a due consideration of the biodiversity benefits inherent to the IBRD-IDB Program and the Green Plan, in particular to those related to planting native trees. Natural regeneration is the only exception to the last affirmation. It appears as a very sound alternative for watershed protection. Besides, it could bring positive impacts in terms of biodiversity conservation. In fact, natural regeneration is one of the ways that have been pointed out for ecosystems restoration one of the main objectives established by the Green Plan.

The study does not take into account the costs associated to technical assistance. This is indeed a major limitation to the conclusions reached as long as those could be very substantial as a Colombian experience has demonstrated. It implies to develop or adapt technologies for an integrated system (that could mean a wide variety of activities, including agriculture, cattle raising, pasture management and forestry in an environmental sustainable way) as well as in depth extension programs; those activities could be oriented to a particular area as the study proposes but at the end requires planning at farm level.

Table No. 8

Minimum incentive and subsidy in different scenarios (in Colombian pesos, 1.999)

WATERSHED	VARIABLE	ESCENARIO				
		1. With hydrological benefits (including sediments reduction)	II. With hydrological, cultural, recreational and private benefits	III: With hydrological and private benefits	IV. With hydrological, social, cultural, recreational and carbon sequestration benefits	
INTEGRATED SYSTEMS	LENGUAZAQUE	Minimum incentive	277	277	277	277
		Subsidy	233	(564)	(4,074)	(4,871)
		Subsidy / Incentive	79%	0	0	0
	RIO DE ORO	Minimum incentive	869	869	869	869
		Subsidy	575	(358)	(9,052)	(9,985)
		Subsidy / Incentive	65%	0	0	0
	GUADALAJARA	Minimum incentive	511	511	511	511
		Subsidy	298	(635)	(2,031)	(2,964)
		Subsidy / Incentive	36%	2%	16%	0
	COMBEIMA	Minimum incentive	2,319	2,319	2,319	2,319
		Subsidy	1,786	542	3,121	1,878
		Subsidy / Incentive	77%	23%	135%	135%
AGRICULTURE	Minimum incentive	2,080	2,080	2,080	2,080	
	Subsidy	1,809	1,215	(2,089)	(2,899)	
	Subsidy / Incentive	87%	58%	0	0	
CATTLE RANCHING RECONVERSION	Minimum incentive	630	630	630	630	
	Subsidy	360	(235)	(3,539)	(4,349)	
	Subsidy / Incentive	57%	0	0	0	
NATURAL REGENERATION	Minimum incentive	646	646	646	646	
	Subsidy	365	(229)	(3,533)	(4,343)	
	Subsidy / Incentive	57%	0	0	0	
PROTECTIVE PRODUCTOR FOREST	Minimum incentive	2,460	2,460	2,460	2,460	
	Subsidy	2,505	2,148	166	(320)	
	Subsidy / Incentive	101%	86%	11%	6%	
IBRD-IDB PROGRAM 80-20	Incentive	1,360	1,360	1,360	1,360	
	Subsidy	1,089	495	(2,809)	(3,619)	
	Subsidy / Incentive	80%	36%	0	0	

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