

# The prospects for Reduced Emissions from Deforestation and Degradation (REDD) in Mesoamerica

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## SUMMARY

The general reluctance of policy makers to include forests in discussions about global warming has changed with the development of measures to Reduce Emissions from Deforestation and Degradation (REDD). Mesoamerica presents a logical starting point to promote REDD due to the extent of its forest, and the relatively advanced state of its forest management institutions and policies. This paper reviews the prospects for REDD in Mesoamerica using PES and other instruments, with emphasis on the effectiveness of REDD measures at reducing emissions, and their efficiency and fairness. It concludes that in spite of reduced deforestation in the region, the growth of payments to avoid deforestation will be the most important policy change related to REDD in the region in the coming years. However, the magnitude and impact of any payments must not be exaggerated and should be set in context of the overall trends resulting from broader social and economic dynamics.

Keywords: REDD, Mesoamerica, PES, community forests, institutions

## Le futur des émissions réduites provenant de la déforestation et de la dégradation (REDD) en Méso-Amérique

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Le manque d'enthousiasme général perceptible au niveau de la conception des politiques d'action dans les discussions sur l'effet serre a changé depuis le développement des mesures prises pour réduire les émissions provenant de la déforestation et de la dégradation (REDD). La Méso-Amérique représente un point de départ logique pour promouvoir la REDD du fait de l'étendue de ses forêts, et de l'état raisonnablement avancé de ses institutions et de ses politiques de gestion forestière. Cet article examine les espoirs de la REDD en Méso-Amérique en utilisant le PES et d'autres instruments, tout en soulignant l'efficacité des mesures de la REDD pour réduire les émissions, ainsi que la justice avec laquelle ses actions sont opérées, et son succès général. Il en conclut que la croissance des paiements pour éviter la déforestation va être le changement de politique le plus important relié à la REDD dans la région dans les années à venir, et ce, malgré la réduction de la déforestation dans cette même région. Il est important cependant que l'envergure et l'impact de tout paiement ne soit pas exagérés, et qu'il s'opèrent dans le contexte des courants généraux résultant des dynamiques économiques et sociales plus larges.

## Perspectivas para Reducción de Emisiones por Deforestación y Degradación (REDD) en Mesoamérica

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En general los responsables de formular políticas se mostraron reacios en cuanto a la inclusión de los bosques en las discusiones sobre el calentamiento global, pero esto ha cambiado con el desarrollo de medidas para reducir las emisiones por deforestación y degradación (REDD). Mesoamérica constituye un punto de partida lógico para la promoción de REDD debido a la extensión de sus zonas forestales y el estado relativamente avanzado de sus instituciones y políticas de gestión forestal. Este artículo examina las perspectivas para la REDD en Mesoamérica mediante el uso de PES (Pago por Servicios Ambientales) y otros instrumentos, y se centra en un análisis de la eficacia de medidas de REDD respecto a la reducción de emisiones, y su eficiencia e imparcialidad. El estudio concluye que, a pesar de una reducción de la deforestación en la región, el aumento de los pagos para evitar la deforestación será el cambio político más importante de los próximos años en cuanto a REDD. Sin embargo, la magnitud y el impacto de estos pagos no deben ser exagerados, y hay que considerarlos dentro del contexto de las tendencias globales que son el resultado de una dinámica social y económica más amplia.

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## INTRODUCTION

Until recently, policy discussions about global warming paid scant attention to forests. Most policymakers viewed emissions resulting from forest loss as hard to measure, monitor, and control. They felt any benefit from efforts to reduce them would be short-lived and suffer considerable leakage (i.e. less carbon emissions in one place would lead to more emissions someplace else). Many worried that focusing on tropical deforestation would reduce pressure on richer countries to lower their emissions or limit governments' sovereign rights to decide how to use their forests. There were fears that including forests in trading schemes would flood the carbon markets and make other types of measures to reduce emissions unprofitable. As a result, the Kyoto Protocol provided few incentives for reforestation and none to maintain existing forests.

Nonetheless, lately interest in measures to Reduced Emissions from Deforestation and Degradation (REDD) has increased markedly. Analysts have realized that the emission reductions needed to avert catastrophic climate change are so large they will be almost impossible to achieve without reducing forest loss. Deforestation and forest degradation accounts for about 18% of global carbon emissions and REDD is potentially a cost-effective way of lowering emissions (Stern 2006). That has improved the concept's popularity, despite the inherent difficulties.

Of all the regions where one might promote REDD, Mesoamerica would seem a logical place to start.<sup>1</sup> It has lots of forest, greater institutional capacity, clearer forest tenure rights, and a stronger system of protected areas than many tropical regions, suffered high rates of forest loss, large areas of forests managed by indigenous peoples and other community groups, and pioneered the use of Payment for Environmental Services (PES).

However, even in Mesoamerica REDD will not be easy or straightforward. To make real progress will require more targeted and efficient PES schemes, clearer tenure rights, better monitoring and analysis of forest cover change, and a more holistic approach to reducing deforestation. There are major trade-offs between fairness and efficiency. There are also important questions about the distributional effects of REDD efforts.

This paper reviews the prospects for REDD in Mesoamerica using PES and other instruments, with emphasis on the effectiveness of REDD measures at reducing emissions, and their efficiency and fairness. It describes the region's forest resources and ownership and patterns of forest loss and recovery. Then it assesses the region's experience with institutions and policies that potentially reduce deforestation and discusses the prospects for REDD going forward. The paper does not address the important issue of the potential ancillary benefits of REDD such as biodiversity conservation and forests' provision of other environmental services.

## THE CONTEXT

**Forest Resources and Tenure**

According to the FAO, in 2005 Mesoamerica had 86.6 million hectares of forest (2.2% of the world's total). Mexico accounted for almost three quarters of that. In addition, there were 24.9 million hectares of "other wooded lands" (FAO 2005). (See Table 1).

Roughly half of Mexico's forests are temperate and half are tropical (Bray, Merino-Perez, and Barry 2005). Over 80% of Central America's forest is tropical broadleaf forest 10% is coniferous, and the rest is mixed broadleaf and coniferous forest. Honduras has three-quarters of Central

TABLE 1 *Forest area and forest area change in Mesoamerica*

Country	Forest area (1000 hectares), 2005	% of land area 2005	Annual change in forest area (1000 hectares) 1990-2000	Annual change in forest area (%) 1990-2000	Annual change in forest area (1000 hectares) 2000-2005	Annual change in forest area (%) 2000-2005
Mexico	64,238	33.7	-348	-0.5	-260	-0.4
Belize	1,653	72.5	0	0	0	0
Costa Rica	2,391	46.8	-19	-0.8	3	0.1
El Salvador	298	14.4	-5	-1.5	-5	-1.7
Guatemala	3,938	36.3	-54	-1.2	-54	-1.3
Honduras	4,648	41.5	-196	-3.0	-156	-3.1
Nicaragua	5,189	42.7	-100	-1.6	-70	-1.3
Panama	4,294	57.5	-7	-0.2	-3	-0.1
Total	86,351	35.7	-729	-0.7	-545	-0.6

Source: FAO (2005)

<sup>3</sup> The term Mesoamerica as used in this paper includes all of Mexico and the seven countries of Central America.

America's coniferous forest (PNUMA/CCAD 2005).

Local communities, organized in *ejidos* or *agrarian communities*, collectively own a majority of Mexico's forests (Bray, Merino-Pérez, and Barry 2005). Individual private farmers own most of the rest. Tenure rights are relatively secure, although agrarian conflicts persist in some areas.

The government owns most of Guatemala's forest, about half of which is in the Maya Biosphere Reserve in the Peten. The government has given community groups in the Reserve 25-year renewable concessions to manage some 500,000 hectares of that to produce timber and non-timber forest products on the condition that those groups are independently certified to confirm that they manage their forests sustainably.

The bulk of Nicaragua's forests are in indigenous territories in the Atlantic Coast regions. Nicaragua's constitution and regional autonomy and indigenous lands laws recognize indigenous rights to own and manage those forests. Nonetheless, most indigenous territories still lack formal titles and forest tenure conflicts are widespread. Most forest outside the Atlantic Coast regions belongs to the government or non-indigenous farmers.

The majority of Panama's forest is in indigenous territories known as *comarcas*. Costa Rica's forests belong to a mixture of private landowners, government, and indigenous communities, all of whom have secure tenure. Forest tenure in Honduras is complex, with many conflicting claims between indigenous communities, individual farmers, and national and municipal governments.

### Forest Loss and Recovery

Forest cover and forest cover change estimates vary widely, as a result of differing definitions, methodologies, and reference years and the biases of the groups that produce them (Velasquez *et al.* 2002). There are also great variations in the amounts of carbon stored by different types of vegetation classified as forests. The Food and Agricultural Organization of the United Nations (FAO) produces the only regular forest cover estimates for every country in Mesoamerica, but its figures are subject to substantial error and often differ markedly from other sources.

Despite that, it is generally agreed that between 1970 and 1990 Mesoamerica had some of the highest deforestation rates in the world. All eight countries in the region lost much of their forest in that period. The 1990 FAO Forest Resources Assessment estimated the region lost 1.5% of its forest annually between 1980 and 1990 (FAO 1993). Most of that forest was converted into pasture and crops, with large and medium-sized ranchers, small farmers, and government agricultural colonization schemes playing important roles. For each hectare of forest lost in Mexico between 30 and 170 tons of carbon were emitted into the atmosphere, depending on the type of forest (Adger *et al.* 1995).

Deforestation rates in Mesoamerica tend to be higher in areas close to roads and markets and in places with more favorable conditions for agriculture (i.e. flatter lands and better soils) (Chomitz and Gray 2003, Ludeke *et al.* 1990,

Muñoz-Pina *et al.* 2003, Rosero-Bixby and Palloni 1998). In Mexico tropical forests have much higher deforestation rates than temperate ones (Muñoz-Pina *et al.* 2003). Indigenous territories in Central America and areas with consolidated community forest management in Mexico and Guatemala typically have lower deforestation rates (Bray *et al.* 2007, Nelson *et al.* 2001, Stocks *et al.* 2007).

Since the late-1980s regional deforestation rates have declined and the patterns of forest cover change have become more diverse. Even though the FAO Forest Resource Assessments are notoriously inaccurate, it is noteworthy that they show the annual deforestation rate in the region fell from 1.1 million hectares in 1980-1990 to 0.7 million hectares in 1990-2000, and 0.5 million hectares in 2000-2005 (FAO 2005; FAO 1993).

The main reasons for that decline include: 1) most remaining forest is in places less suitable for agriculture with steep slopes, poor soils, and/or high rainfall; 2) governments reduced their support for agricultural colonization and cattle ranching; 3) an increasing percentage of remaining forests is in protected areas and/or indigenous territories; 4) extensive low productivity cattle ranching has become less profitable in many places; 5) rapid out-migration from rural areas to cities and to the United States and the growth of off-farm rural employment has left fewer young men interested in clearing forest; and 6) governments have increased their support for reforestation, conservation, and forest management on private and community-owned lands. Unfortunately, due to the paucity of accurate land use data and a drop-off in research about forest cover change and rural issues generally, little is known about the relative importance of these factors.

Some of these trends are unique to Mesoamerica. Others reflect the broader historical trend towards "forest transitions", in which forest loss slows down or is even reverted as countries become richer, more urban, and more environmentally conscious (Rudel *et al.* 2005).

The forest transitions in Costa Rica, El Salvador, and the Pacific Regions of Panama and Nicaragua are already well advanced. Costa Rica reported a small net increase in forest cover between 2000 and 2005. Hecht *et al.* (2006) report El Salvador's forest cover increased 40% between 1992 and 2001. Similar processes seem to be underway in some long-inhabited Mexican regions with high emigration and limited aptitude for agriculture (López *et al.* 2006).

Meanwhile rapid deforestation continues in many agricultural frontier areas, particularly in the humid tropics. These include parts of eastern Tabasco and the highlands of Chiapas in Mexico, the western Peten in Guatemala, eastern Olancho in Honduras, Nicaragua's Atlantic Coast regions, and the Provinces of Panama, Colon, and Darien and the Comarca Ngöbe Bugle in Panama. Forest clearing has been especially rapid in areas that were largely spared during the 1980s due to armed conflicts and opened or re-opened for settlement once those conflicts subsided. There is also reason for concern that rising agricultural prices and growing demand for biofuels could push deforestation rates back up, although it is still too early to assess that possibility.

## MESOAMERICA'S EXPERIENCE WITH MEASURES FAVORING REDD

Possible measures to reduce carbon emissions from deforestation and forest degradation include: 1) strong environmental institutions 2) payments for maintaining natural forests, 3) protected areas that effectively restrict certain land uses, 4) support for community and indigenous forest management, 5) efforts to increase the profitability of sustainable production of forest products, regular and systematic monitoring and analysis of deforestation and forest degradation, 6) effective enforcement of rules and regulations restricting deforestation and degradation, 7) infrastructure policies that limit access to forested areas, and 8) macroeconomic and agricultural policies that make it less profitable to clear additional forest land for livestock and crops.

The following section examines Mesoamerica's experience in each of these eight areas. The region has made more progress in the first four areas than most other developing country regions. It has made much less progress in the last four areas.

### Environmental Institutions

Compared to most of Africa and Asia and other parts of Latin America, Mesoamerica has reasonably well-consolidated national and regional environmental agencies with capacity to implement forestry and conservation policies. This is particularly true in Mexico, Costa Rica, and Panama; less so in Guatemala, Honduras, and Nicaragua. The first set of countries uses their national budgets and loans from multilateral banks to finance the majority of their forestry and conservation activities, while the second relies more on donations or highly subsidized loans from foreign funders.

The Mexican government devotes more resources to forest-related activities than all other Mesoamerican governments combined. For 2008 the Mexican Congress approved a budget of just over \$700 million dollars for the National Forestry Commission (CONAFOR), National Protected Areas Commission (CONANP), and Attorney General's Office for Environmental Protection (PROFEPA). Of that perhaps 20% or 30% goes to activities that contribute to REDD directly or indirectly (Greenpeace 2007).

Over the last two decades, Mesoamerica has prepared many regional and national plans and strategies related to the environment, forests, protected areas, biodiversity, forest fires, climate change, and other related subjects (PNUMA / CCAD 2005). While these exercises have served a useful purpose in helping to collect and analyze information and to promote policy dialogue most have had notably little influence on the policies that the governments actually implemented.

### Payments for Maintaining Natural Forests

Mesoamerica was among the first regions in the developing world to experiment with paying landowners to maintain forest

cover. International NGOs promoted the first initiatives in the 1980s and early 1990s. Then the Costa Rican government began a formal Payment for Environmental Services (PES) program in 1997 and Mexico followed six years later. Other countries have initiated more modest programs since.

*Early Experiences:* The first forest carbon project was a CARE project in Guatemala, funded by Allied Energy Services in the late 1980s. It focused on planting trees in agroforestry systems and woodlots. Other projects followed in the mid-1990s, including the CARFIX project in Braulio Carrillo National Park, ECOLAND project in Piedras Blancas National Park, BIODIVERSIFIX project in the Guanacaste Conservation Area, and Klinki Forestry Project in Turrialba in Costa Rica, a carbon sequestration project in the Rio Bravo Conservation and Management Area in Belize, the Fondo Bioclimático Project in Chiapas, Mexico and the Chiriqui Reforestation Project in Panama (Moura-Costa and Stuart 1998). The United States Initiative on Joint Implementation (USIJI) established in 1994 supported these projects, most of which involved large international NGOs and electrical companies. The projects supported protected areas and reforestation, not conservation on private or collectively owned lands.

These early projects contributed to developing key concepts and tools related to using forests as carbon sinks. The areas involved were relatively small and the projects had limited impact on national deforestation rates.

*Costa Rica:* In the mid-1990s Costa Rica expanded an incentive program designed to encourage reforestation for timber production to also include support for sustainable forest management and conservation. Soon after it shifted from timber to a major new initiative to pay landowners for the environmental services they provided. In 1996 the Costa Rican national assembly passed a forestry law (7575) that established a formal legal and institutional framework for these payments, focused on carbon sequestration, hydrological services, biodiversity conservation, and scenic beauty.

To manage the PES program Law 7575 created the National Fund for Forest Financing, (FONAFIFO) as a semi-autonomous agency with both public and private sector representatives on its board. FONAFIFO designs the procedures for the program, collects funds from various sources, and maintains records and statistics. Since 2003 it has also directly received applications from landowners, signed contracts, and monitored their compliance. Certified foresters called *regentes* help landowners develop forestry plans and apply for funds and they assist FONAFIFO in monitoring landowners' compliance with their contracts (Pagiola 2006).

Between 1997 and 2006, the Costa Rican government signed 6,062 contracts with private landholders to conserve natural forest, reforest, manage forests, and establish agro-forestry systems. Over this period the government paid landholders to conserve 471,392 hectares and to manage another 28,066 hectares sustainably (FONAFIFO 2007). Strict conservation has accounted for over 90% of the area the program has covered since 1998. About 270,000 hectares of forest were enrolled in the program in late 2005 (Pagiola 2006).

Costa Rica pays landholders about \$240 per hectare of forest to conserve that forest for five years (i.e. \$48 per hectare per year) (Zbinden and Lee 2005). Landholders must prepare a forest management plan and take steps to avoid fires, hunting, logging, and grazing in the forest (Pagiola 2006). Landholders who meet their obligations receive five equal annual payments. The transactions costs for administering the system, including the costs of both FONAFIFO and the *regentes* range from 19% to 25% of the program's total costs (Wunder 2006).

Demand to participate in the program has consistently surpassed available funds. Typically there have only been enough funds to cover about one third of the area landowners offer (Pagiola 2006). Although in recent years the program has made efforts to target areas that provide more environmental services it has not made any attempt to prioritize areas where one could reduce deforestation most for the least money.

Over the last decade Costa Rica invested over \$200 million in PES (CONAFOR 2007). These funds came mostly from a sales tax on gasoline, the Global Environment Facility (GEF), World Bank loans, the German and Norwegian governments, various water users, and European companies (Pagiola 2006).

Econometric studies that have assessed how much Costa Rica's PES program reduced deforestation have yielded mixed results. Some suggest the program has achieved modest reductions, others that the effect has been negligible (Pagiola 2006, Pfaff *et al.* 2006). The studies all agree that many landowners who received payments would have conserved their forest even without them and that the decline in Costa Rica's national deforestation rates cannot be attributed principally to the payments.

Most benefits from Costa Rica's PES program have gone to companies and large individual landowners. Zbinden and Lee (2005) found program participants in the northern lowlands of Costa Rica had much more land and securer land tenure than non participants. Ortiz-Malavasi, Sage-Mora, and Borge-Carvajal (2003) estimated only about 15% of PES recipients could be considered poor and found that a substantial portion of them were absentee landowners who made their living mostly from non-agricultural activities. The government made little, if any effort, to specifically target payments to poorer and smaller landowners. Nonetheless, the PES program has represented an important source of income for poor Bribri and Cabecara indigenous communities in Talamanca and low-income land-owners in the Osa Peninsula (Pagiola 2006, Rojas *et al.* 2007).

*Mexico:* Mexico began its PES program in 2003. Initially the program focused solely on conserving forests to provide hydrological services (PSA-H), but it later expanded to include carbon sequestration, biodiversity, and agroforestry (PSA-CABSA). The government forestry agency CONAFOR administers the program. To qualify for hydrological services payments, land must have dense forest cover and be located near towns with over-exploited aquifers and more than 5,000 inhabitants. CONAFOR gives preference to areas with cloud forest and to poorer municipalities with fewer services (Alix-García *et al.* 2005).

To receive payments landowners must commit to maintain their land in forest for five years. In return they receive \$40 / hectare each year for cloud forest and \$30 / hectare for other forests (Alix-García *et al.* 2005). In theory payments can only be made for one five year period. It is not clear what the government expects to happen after that. Transactions costs, including the costs of both CONAFOR and private foresters that help recipients to obtain payment, represent a portion of total costs similar to Costa Rica.

Between 2003 and 2006 the Mexican government provided payments for 680,000 hectares of conservation and agroforestry systems. Total payments have increased from \$3.6 million in the program's first year to over \$100 million dollars in 2007 (Alix-García *et al.* 2005). CONAFOR 2007). The federal budget, a World Bank loan, and a GEF grant provided practically all of that.

As in Costa Rica, it is not clear how much Mexico's PES program has contributed to REDD. CONAFOR has made little effort to target forests that have a high risk of being cleared. In fact, most forests involved in the program have a low or very low risk of deforestation and many belong to well-organized communities that have managed their forests sustainably for years. Even though deforestation rates are much higher in the tropics, the temperate areas have received most of the money (Alix-García *et al.* 2005).

Unlike Costa Rica, most of the money in Mexico has gone to poor communities that manage their forests collectively. In 2005, 83% of the payments went to ejidos and agrarian communities, of which 38% had indigenous inhabitants (Magaña-Torres *et al.* 2006).

*Other PES projects:* The World Bank has promoted PES in El Salvador and Nicaragua and the Inter-American Development Bank (IADB) in Guatemala and Honduras. A number of bilateral donors and international NGOs have supported PES projects focused on hydrological or biodiversity services. These efforts have been smaller and less institutionalized than those in Costa Rica or Mexico. Nevertheless, they have created at least an incipient capacity to implement PES activities in these other countries.

### Protected Areas

Few regions in the world have given protected status to a higher percentage of their forest than Mesoamerica. Over half of Central America's forest was in protected areas in 2006, of which there were 743 covering 14.3 million hectares (CCAD / CAC 2007). About 12% of Mexico's forest is in protected areas, of which there are 161 federal protected areas, covering 22.7 million hectares.

Much of Central America's forest in protected areas is concentrated in a few large Biosphere Reserves: the Maya and Sierra de las Minas Reserves in Guatemala, the Rio Platano Reserve in Honduras, the Bosawas and South-east Reserves in Nicaragua, the Amistad and Central Volcanic Corridor Reserves in Costa Rica, and the Darien Biosphere Reserve in Panama. Mexico's main forested biosphere reserves are Calakmul, La Sepultura, Las Tuxtlas, Montes Azules, Sian Kan, and Sierra Gorda.

International agencies and national governments have invested heavily in these protected areas, with mixed results. Belize and Costa Rica have largely been able to control encroachment (Chomitz and Gray 2003). Mexico has also succeeded in many areas (Bray *et al.* 2007), although some areas have substantial encroachment and illegal logging and many are “paper parks” with no staff or regular field activities (CONABIO 2006).

On the other hand, the parts of the Maya, Bosawas, and Rio Platano Biosphere Reserves outside community forest concessions or indigenous territories have suffered widespread deforestation, despite large investments there. For example, between 1990 and 2005, farmers and ranchers deforested nearly 50,000 hectares inside the Laguna del Tigre and Sierra del Lacandón National Parks in Guatemala’s Maya Biosphere Reserve (Central America Report 2007).

Donors such as the GEF, the United States Agency for International Development (USAID), and European bilateral development agencies have provided much of the funding for protected areas in Mesoamerica. In recent years, however, they have reduced their support, raising serious questions about how these areas will be funded in the future, particularly in the poorer countries.

### **Community Forestry and Indigenous Territories**

CONAFOR in Mexico is the government agency in the region that has invested the most in community forest management. Funding for community forestry has gradually increased since CONAFOR was established in 2002. For 2008, the Mexican Congress approved a budget of some \$70 million for community forestry activities, which represented 14% of CONAFOR’s budget (Enciso 2007). These efforts have re-enforced the pre-existing trend towards lower deforestation rates in areas where community forestry enterprises manage forests for timber production. In many cases these rates are as low as or lower than in protected areas (Bray *et al.* 2007).

Guatemala has also had considerable success in limiting forest clearing and forest fires in the 500,000 hectares with community forestry concessions. While the country’s National Protected Areas Commission (CONAP) is ostensibly responsible for these concessions, foreign donors have provided most of the funding.

Government recognition and support for indigenous territories has curtailed deforestation in the northern portion of the Bosawas Biosphere Reserve in Nicaragua, in Talamanca in Costa Rica, and in the Darien in Panama. The demarcation and titling of the forests inhabited by Miskitu Indians in eastern Honduras and Nicaragua might yield similar results, but progress has been slow due to political opposition and the weaknesses of the relevant government agencies.

### **Increasing Profitability of Sustainable Forest Production**

If sustainable production of timber and non-timber forest products was more profitable that might reduce the incentive

to clear forests for agriculture and reduce emissions resulting from poor forest management. The main empirical evidence for this in the region is the previously mentioned low deforestation rates in many of the better managed and more profitable community forests in Mexico and Guatemala.

Besides the previously mentioned government efforts to support community forestry, the main instrument designed at least partially to increase the profitability of sustainable forest management in the region has been independent certification, mostly by groups linked to the Forest Stewardship Council (FSC). To date 1.4 million hectares of forest have been certified in Mesoamerica under FSC standards (FSC 2008). These efforts have helped to improve the management of these forests and in some cases to access new markets and maintain rights over forests, however, so far they have done little to increase the prices received by those with certified forests (Mota Villanueva 2005).

### **Monitoring and Analysis of Deforestation**

Despite large investments in geographic information systems (GIS), environmental information systems, and indicators of sustainability, no Mesoamerican country regularly monitors forest cover rigorously and systematically (although Costa Rica comes close.) As a result, none of the region’s countries with significant deforestation would be well placed to estimate how much REDD efforts reduced that deforestation. The lack of systematic monitoring is largely due to weak coordination between government agencies, frequent changes in government policies and institutions, a preference for funding short-term consultancies and the purchase of equipment and software rather than recurrent expenditures, and policymakers’ desire to avoid being held accountable if they fail to reduce deforestation.

### **Regulatory Efforts to Limit Deforestation and Forest Degradation**

Most, if not all, of the countries in the region have laws prohibiting clearing of forests to plant pasture or crops without authorization from the government to do so. However, none of the governments devote significant funds or attention to enforcing those laws. Even though deforestation for agriculture has consistently been the main cause of forest destruction, the governments devote the vast majority of their forest law enforcement resources to regulating timber production.

Similarly, the countries have detailed laws and regulations specifying who can harvest timber and under what conditions. Nonetheless, due to limited resources for enforcement and lack of coherent enforcement strategies, poorly designed legislation, corruption, and weak commitment within the judicial system, illegal logging is widespread in the region (CCMSS 2007). Where it occurs in protected areas and other places where there would otherwise be no logging, it leads to greater carbon emissions. In other cases where logging is illegal because loggers have not paid taxes or complied with administrative procedures it is unclear whether the illegality

of the logging implies greater carbon emissions.

In recent years illegal logging has gotten much more attention from policymakers in Mesoamerica, particularly in Mexico, Honduras, and Nicaragua. Nonetheless, so far this does not seem to have significantly reduced illegal logging. Most control efforts are poorly designed and sporadic and there is little coordination between the different actors involved.

### Infrastructure Policies

Improving access often creates powerful incentives to clear or exploit forests. Constructing and improving roads into forested areas played a key role in the forest destruction that took place in the region in recent decades (Chomitz and Gray 2003, Denninger and Minten 1997, Ludeke *et al.* 1990, Rosero-Bixby and Palloni 1998).

Road construction and improvement continues to pose major threats to forests in the region. One recent study of ten road projects in the region near the borders between Mexico, Guatemala, and Belize estimates these projects would cause the loss of over 300,000 additional hectares of forest over the next 30 years (Amor Conde *et al.* 2007). Road projects also pose big threats to forests in the Atlantic regions of Nicaragua and Honduras, and the Darien in Panama, among others.

All Mesoamerican governments require Environmental Impact Assessments (EIA) for large road projects. However, most EIAs are simply expensive exercises that don't significantly alter the projects' approval or design. Governments have only succeeded in implementing measures to effectively mitigate the negative impact of roads on forests in a few cases, mostly in Costa Rica and Panama. While the World Bank and the IADB have become much more sophisticated in their analysis of the impacts of road projects in forested areas and have increasingly shied away from such projects, governments have often been able to find other funding sources for such projects and go ahead without multilateral involvement.

### Macro-economic and Agricultural Policies

Macro-economic and agricultural policies that influence the profitability of agriculture and forestry have large impacts on forest clearing and harvesting. Exchange rate fluctuations, changes in tariffs and other trade barriers, agricultural subsidies, and land tenure policies are especially important in this regard (Barbier and Burgess 1996, Kaimowitz and Angelsen 1998).

Many policies implemented over the last fifteen years have made agriculture and forestry less profitable, particularly in agricultural frontier regions (Hecht *et al.* 2006). The massive influx of foreign exchange from remittances, tourism, narcotics, petroleum, and the sale of public enterprises have strengthened local currencies, which negatively affects agriculture and forestry. Free trade agreements have forced Mesoamerican ranchers and farmers to compete more directly with their heavily subsidized counterparts in

the United States. Government subsidies for agricultural credit and colonization have declined. The privatization of collective landholdings probably facilitated migration out of rural areas. None of these policies was designed to reduce deforestation or forest degradation but they probably had that effect.

Nonetheless, certain policies continue to favor deforestation. For example, Mexico's PROCAMPO agricultural subsidy program has apparently encouraged deforestation in South-east Mexico (Klepeis and Vance 2003). Mexico has also actively encouraged farmers to expand avocado production in Michoacán, even though this often leads to clearing pine forests to plant avocados. The recently negotiated Central American Free Trade Agreement may make cattle ranching in agricultural frontier areas more profitable, by opening up new markets for beef. Biofuel subsidies have encouraged forest clearing to plant oil palm.

### THE OUTLOOK FOR PES AS PART OF REDD STRATEGIES GOING FORWARD

Mesoamerican deforestation will probably continue to fall. There are fewer forests left to clear. Those that remain are largely in places with steep slopes and poor soils. Government policies are largely unfavorable to agriculture and forestry. There are clear signs of forest transitions in various places.

It remains to be seen, however, to what extent new REDD measures could greatly accelerate that trend. The main measure being discussed at present is providing significant international funding to PES programs designed to conserve natural forests.

As noted above, there is little evidence the PES programs and projects implemented to date have significantly reduced deforestation. That is largely because payments have gone mostly to maintain forests that were not really threatened.

For PES to achieve REDD they would have to be much better targeted towards forests that are really at risk of being cleared or degraded. Current remote sensing technologies and modeling techniques allow one to identify with some accuracy which forests those are.

However, targeting forests at risk is more problematic than it appears. Landowners that manage their forests well would undoubtedly object to being excluded from the program and might have considerable clout with forestry agencies. It seems – and it is – perverse and unfair to pay landowners that seem likely to clear their forests but not those that have consistently managed it well. In the medium-term only compensating landowners for forests at risk would create a substantial incentive for them to put their forests at risk by destroying or threatening to destroy part of it, particularly if those landowners had not really managed their forests until they began receiving payments. Indeed, some farmers in Mexico and Nicaragua whose PES were about to end in have threatened to destroy their forests unless they continued to receive payment.

Many forests that are most at risk of being cleared or degraded have more than one claimant, particularly in

Guatemala, Honduras, and Nicaragua. That makes it hard to determine who should receive PES and more likely that whoever does receive the PES will not be able to ensure that the forest will be preserved. There is also a risk that by making these forests more valuable PES programs might encourage greater conflicts since each claimant would stand more to gain by winning control over the forests. Governments will find it difficult to pay groups that lack formal title to their lands or that occupy government forest lands illegally and payments to the latter groups could encourage further illegal occupations.

So far the main PES programs have been in countries that have had the institutional capacity to implement them. However, a greater emphasis on forests at risks also implies the need to expand these efforts into countries such as Honduras and Nicaragua, which have relatively high deforestation rates and much less institutional capacity than Mexico or Costa Rica. That presents additional challenges.

Making PES more efficient requires not only targeting forests that are truly at risk but also ensuring that landowners do not receive more than the minimum amount necessary to convince them to conserve their forests and do not simply clear the same amount of forest in some other location. The fact that both the Costa Rican and Mexican PES programs are heavily over-subscribed suggests that these programs could pay landowners significantly less and still get them to conserve the same amount of forest. That is hardly surprising given that studies suggest landowners would have conserved most of that forest with no payment at all. Nothing in the existing PES programs limits the ability of landowners to clear forests outside the areas they receive PES payments for.

Presumably if PES programs prioritized forests landowners were more inclined to clear or harvest they would have to pay more than they would have to pay the landowners they currently work with. However, since there have been few studies of the opportunity costs of different land uses in the various regions of Mesoamerica no one knows how much that might be. The studies available for the Amazon and other regions cannot be mechanically applied to Mesoamerica.

Just as PES programs would probably have to pay more per hectare for forests at significant risk the transactions costs involved in working with these forests are also likely to be substantially higher. Costa Rica and Mexico have had relatively little problem with getting landowners to comply with their commitments, since payments went largely to landowners with little inclination to clear or exploit their forests in the forest place. In places where it is much more likely that landholders will fail to comply with their commitments programs will have to devote much more resources to monitoring compliance and impose greater penalties on those that fail to comply.

One particular problem in Mexico is that in many of the ejidos and agrarian communities that have high deforestation rates the communal authorities are relatively weak and there are high levels of internal conflict. That implies it would not be sufficient to sign contracts with the communal authorities and assume they will be in a position to deliver what they

agree to, as is the case with the current program. Additional efforts would be required to build consensus and local monitoring mechanisms in such communities.

One key question in all of this is how much additional international funding might be available for new PES initiatives. Some back-of-the-envelope calculations can give some sense of that. It might be a reasonable starting point to assume that international funders would pay \$10 for each ton of carbon not released into the atmosphere and that for each hectare of forest that is kept from being cleared one can keep 100 tons of carbon from being emitted. That implies avoiding one hectare of deforestation would be worth \$1,000. If one were to reduce the total level of deforestation by 100,000 hectares per year (roughly 15%-20% of current levels) that would be worth \$100 million per year. To achieve that reduction in deforestation might require five or ten annual payments to the owners of each hectare – so the \$100 million would permit \$10 - \$20 million in payments each year; or \$100 - \$200 per hectare. Obviously the true magnitude of each of these parameters could differ significantly from these assumptions, but at least this gives a starting point.

The good news is that \$100-\$200 per hectare per year is substantially more than the Costa Rican or Mexican PES programs currently pay and probably higher than what most landholders could obtain from extensive cattle ranching or low yield cereal production. That could give a little room to maneuver.

The bad news is that in principle at least Mesoamerica would only receive international payments for hectares that are conserved that would otherwise have been deforested. That implies that if only 10% or 20% of the hectares covered by the PES program would otherwise have been cleared, the most landholders could receive would be \$10 or \$20 per hectare. Moreover they would only receive those payments for five or ten years and would have few incentives to keep the forest from being cleared after that. That gives a sense of how much more efficient the new PES initiatives would have to be than current initiatives for the new REDD approach to succeed.

The other piece of bad news is that \$100 million per year is roughly what Mexico already spends on PES. Thus the amounts of additional funds the new REDD initiative might put on the table are not that high compared to what is already being spent; yet the expectations for results would be much higher, as would the imperative of demonstrating them.

How much Mesoamerica could obtain from international REDD funding also depends to a great extent on what base lines and reference scenarios the parties agree on. Negotiators are likely to find it quite hard to come up with reference scenarios that reward countries for both their past and future efforts to conserve forests. If the baselines and reference scenarios adopted are based on the assumption that recent deforestation rates will continue countries like Costa Rica and El Salvador will be unable to participate since their net deforestation is already zero or negative. Such baselines and reference scenarios would essentially punish these countries for having made progress before the REDD initiatives began. One the other hand, a country like Mexico would unduly

benefit from such a reference scenario since it has had high deforestation in the recent but the rate will probably fall in the future even if no REDD measures are taken.

Not rewarding countries for past efforts is efficient, but doesn't seem fair. Rewarding them for reductions that would have taken place anyway is neither efficient nor fair. However, it is extremely difficult to estimate what deforestation rates would have been without REDD measures and would probably be even harder to achieve a political consensus about what specific method should be used to do that.

One final issue that deserves consideration is how new REDD initiatives might affect equity and poverty. As noted previously, Mexico's PES program seems to have benefitted mostly poor communities, many of which are indigenous, while Costa Rica's program has largely benefitted the wealthy.

If one were to give greater priority going forward to heavily threatened forests that could unduly benefit wealthy cattle ranchers, as they are responsible for a large portion of deforestation. Small-holders that clear forests on the agricultural frontier would have much more difficulty participating in PES programs since many of them have no title or clear legal claim to their land, particularly in Central America. Attempts to target REDD initiatives on forests at greater risk would probably affect indigenous peoples and community forestry groups negatively, since they have conserved most of their forest reasonably well and could be expected to continue to do so.

These various considerations imply that Mesoamerica would probably need to find a delicate balance between fairness, equity, and efficiency and to find innovative ways to incorporate poor people into PES initiatives even when they lack land titles or operate illegally. If it goes too far in the direction of fairness and equity it will be difficult to significantly reduce emissions from deforestation and degradation. On the other hand, if it goes too far in the direction of efficiency it will end up rewarding wealthy groups for inappropriate and often illegal behavior, increasing inequality, and undermining the political legitimacy of the entire endeavor.

## CONCLUSION

Over the last twenty years Mexico and Central America have implemented various policies designed to reduce deforestation and degradation, with mixed success. The total annual net loss of forest biomass has declined, although deforestation remains high in certain areas. There have been advances in community and indigenous forest management, protected area management, forest certification, the elimination of perverse incentives to clear forests, and payment for environmental services, among other topics, although much remains to be done in all these areas as well as topics such as road construction and maintenance, forest law enforcement, and monitoring and analysis. Forest cover change has also been affected by broader social changes, such as migration, urbanization, and more recently the rapid

rise in food and energy prices and the growing demand for biofuels.

It seems likely that the growth of payments to avoid deforestation will be the most important policy change related to REDD in the region in the coming years. Such payments have potential to significantly reduce emissions from deforestation and degradation, but there are still many outstanding questions about how to make them more effectively, efficient, and fair, and there are probably significant trade-offs between those three objectives. Moreover, the magnitude of the probable increase in these payments should not be exaggerated. While the amounts of money involved may be substantial, they are unlikely to be sufficient to fundamentally change the overall trends resulting from broader social and economic dynamics.

## REFERENCES

- ADGER, N.W., BROWN, K., CERVIGNI, R., and MORAN, D.. 1995. Total Economic Value of Forests in Mexico, *Ambio* 24: 286-96.
- ALIX-GARCÍA, J., DE JANVRY, A., SADOULET, E. and TORRES-ROJO, J.M. 2005. *An Assessment of Mexico's Payment for Environmental Services Program*. Unpublished paper prepared for the FAO. <http://are.berkeley.edu/~sadoulet/papers/FAOPESreport.pdf>.
- AMOR-CONDE, D., BURGUES, I., FLECK, L.C., MONTEROLA, C. and REID, J. 2007. Análisis ambiental y económico de proyectos carreteros en la Selva Maya, un estudio regional, Serie Técnica #10, Arcata, California, Conservation Strategy Fund.
- BARBIER, E.B. and BURGESS, J.C.. 1996. Economic Analysis of Deforestation in Mexico, *Environment and Development Economics*, Vol. 1, No. 2: 203-39.
- BRAY, D.B., MERINO-PÉREZ, L. and BARRY, D. 2005. Community Managed in the Strong Sense of the Phrase: The Community Forest Enterprises of Mexico, 3-26, in *The Community Forests of Mexico, Managing for Sustainable Landscapes*, D.B. Bray, L. Merino-Pérez, and D. Barry editors, Austin: University of Texas Press.
- BRAY, D.B., DURÁN-MEDINA, E., MERINO-PÉREZ, L., TORRES-ROJO, J.M., and VELÁZQUEZ-MONTES, A. 2007. *Nueva Evidencia: Los bosques comunitarios de México protegen el ambiente, disminuyen la pobreza y promueven la paz social*, Mexico City: Consejo Civil Mexicano para la Silvicultura Sostenible.
- CENTRAL AMERICA REPORT. 2007. Mayan Biosphere Reserve Under Threat, *Central American Report*, October 19: 4-6.
- CHOMITZ, K. and GRAY, D.A. 2003. Roads, Land Use, and Deforestation: A Spatial Model Applied to Belize, *World Bank Economic Review*, Vol 10 (3): 487-512.
- COMISIÓN CENTROAMERICANA DE AMBIENTE Y DESARROLLO (CCAD)/CONSEJO AGROPECUARIO CENTROAMERICANO (CAC). 2007. *Programa estratégico regional para el manejo de los ecosistemas forestales*, PERFOR (draft), San Salvador: CCAD.

- COMISIÓN NACIONAL PARA EL CONOCIMIENTO Y USO DE LA BIODIVERSIDAD (CONABIO). 2006. *Capital natural y bienestar social*. Mexico City: CONABIO.
- COMISIÓN NACIONAL FORESTAL (CONAFOR). 2007. *Distribución de recursos de Proarbol en 2007*. Zapopan, Jalisco: CONAFOR, December 27, <http://www.conafor.gob.mx/portal/docs/secciones/comunicacion/B-1042007.pdf>
- CONSEJO CIVIL MEXICANO PARA LA SILVICULTURA SOSTENIBLE (CCMSS). 2007. El mercado ilegal de la madera en México, *Nota informativa No. 16*, México City: CCMSS.
- DEININGER, K. and MINTEN, B. 1997. *Determinants of forest cover and the economics of protection: an application to Mexico*, Washington D.C.: World Bank.
- ENCISO, A. 2007. Greenpeace: El presupuesto insuficiente para atender la crisis en selvas y bosques, *La Jornada*, Mexico City, October 24.
- FONDO NACIONAL DE FINANCIAMIENTO FORESTAL (FONAFIFO). 2007. Servicios Ambientales, Estadísticas PSA, [http://www.fonafifo.com/paginas\\_espanol/servicios\\_ambientales/sa\\_estadisticas.htm](http://www.fonafifo.com/paginas_espanol/servicios_ambientales/sa_estadisticas.htm)
- FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS (FAO). 2005. *Global Forest Resources Assessment 2005, Progress Towards Sustainable Forest Management*. FAO Forestry Paper 147. Rome: FAO.
- FAO. 1993. *Forest Resource Assessment 1990, Tropical Countries*. FAO Forestry Paper 112. Rome: FAO.
- FOREST STEWARDSHIP COUNCIL (FSC). 2008. *Global FSC Certificates: Type and Distribution*. (Ap ril). [http://www.fsc.org/fileadmin/web-data/public/document\\_center/powerpoints\\_graphs\\_facts\\_figures/08-04-01\\_Global\\_FSC\\_certificates\\_-\\_type\\_and\\_distribution\\_-\\_FINAL.pdf](http://www.fsc.org/fileadmin/web-data/public/document_center/powerpoints_graphs_facts_figures/08-04-01_Global_FSC_certificates_-_type_and_distribution_-_FINAL.pdf)
- GREENPEACE. 2007. *Erróneo e insuficiente el presupuesto 2008 para bosques*. México City, [http://www.greenpeace.org/mexico/news/err-neo-e-insuficiente-el-pres#Scene\\_1](http://www.greenpeace.org/mexico/news/err-neo-e-insuficiente-el-pres#Scene_1)
- HECHT, S.B., KANDEL, S., GOMES, I., CUELLAR, N. and ROSA, H. 2006. Globalization, Forest Resurgence, and Environmental Politics in El Salvador, *World Development*, Vol. 34 (2): 308-23.
- KAIMOWITZ, D. and ANGELSEN, A. 1998. *Economic Models of Tropical Deforestation: A Review*, Bogor: Center for International Forestry Research (CIFOR).
- KLEPEIS, P. and VANCE, C. 2003. Deforestation and Neoliberal Policy in Southeastern Mexico, An Analysis of the PROCAMPO Program, *Economic Geography*, Vol. 79 (3):221-40.
- LÓPEZ, E., BOCCO, G., MENDOZA, M., VELÁZQUEZ, A. and AGUIRRE-RIVERA, J.R. 2006. Peasant Emigration and Land Use Change at the Watershed Level: A GIS-Based Approach in Central Mexico, *Agricultural Systems*, Vol 90 (1-3): 62-78.
- LUDEKE, A.K., MAGGIO, R.C. and REID, L.M. 1990. An Analysis of Anthropogenic Deforestation Using Logistic Regression and GIS, *Journal of Environmental Management*, Vol 31 (3):247-59.
- MAGAÑA TORRES, O., VERA CASTILLO, G., VALTIERRA PACHECO, E., LEYVA OVALLE, A., CASTILLO CALIPA, M., VANEGAS LÓPEZ, M., LOZANO CONTRERAS, M. and GAMEZ ZAPATA, B. 2006. *Evaluación externa del program de pago de servicios ambientales hidrológicos, ejercicio fiscal 2005*. Chapingo: Gerencia de Servicios Profesionales, Universidad Autónoma de Chapingo.
- MOURA-COSTA, P.H. and STUART, M.D. 1998. Forest-Based Greenhouse Gas Mitigation: A Short Story of Market Evolution, *Commonwealth Forestry Review*, 77: 191-202.
- MUÑOZ-PIÑA, C., ALARCÓN, G., FERNÁNDEZ, J.C. and JARAMILLO, L. 2003. *Pixel Patterns of Deforestation in Mexico*. Mexico City: Instituto Nacional de Ecología.
- NELSON, G.C., HARRIS, V. and STONE, S.W. 2001. Deforestation, Land Use and Property Rights: Empirical Evidence from Darien, Panama, *Land Economics*, Vol. 77, No. 2: 187-205.
- ORTIZ-MALAVASI, E., SAGE-MORA, L. and BORGE-CARVAJAL, C. (2003). *Impacto del Programa de Pago de Servicios Ambientales en Costa Rica como medio de reducción de la pobreza en los medios rurales*. San Jose, Costa Rica: Regional Unit for Technical Assistance (RUTA).
- PAGIOLA, S. 2006. Payments for Environmental Services in Costa Rica Revised version of a paper presented at the ZEF-CIFOR workshop on Payments for environmental services: Methods and design in developing and developed countries, Titisee, Germany, June 15-18 2005. Available a t <http://mpr.ub.uni-muenchen.de/2010/>
- PAFF, A., ROBALINO, J.A. and SÁNCHEZ-AZOFEIFA, A. 2006. Payments for Environmental Services: Empirical Analysis for Costa Rica. Columbia University, PROGRAMA DE MEDIO AMBIENTE DE NACIONES UNIDAS (PNUMA) / COMISIÓN CENTROAMERICANA DE AMBIENTE Y DESARROLLO (CCAD). 2005. *GEO Centroamerica, Perspectivas del Medio Ambiente 2004*. Mexico D.F.: PNUMA.
- ROJAS, V., MARTÍNEZ, A., CANDELA, S. and CHEVERRY, D. 2007. *Caracterización de una experiencia exitosa de pago de servicios ambientales (PSA) en los territorios indígenas Bribri y Cabecar en Costa Rica*, San Jose: ACICAFOC.
- ROSETO-BIXBY, L. and PALLONI, A. 1998. Population and Deforestation in Costa Rica, *Population and Environment*, Vol 20 (2): 149-85.
- RUDEL, T.K., COOMES, O.T., MORAN, E., ACHARD, F., ANGELSEN, A., XIU, J. and LAMBIN, E. 2005. Forest Transitions: Towards a Global Understanding of Land Use Change, *Global Environmental Change*, Vol 15(1): 23-31.
- STERN, N. 2006. *The Economics of Climate Change, The Stern Review*. Cambridge: Cambridge University Press.
- STOCKS, A., MCMAHAN, B. and TABER, P. 2007.

- Indigenous, Colonist, and Government Impacts on Nicaragua's Bosawas Biosphere Reserve, *Conservation Biology*, Vol 21 (6): 1495-1505.
- VELASQUEZ, A., MAS, J.F. and PALACIO, J.L. 2002. Análisis del cambio de uso del suelo. Mapas del Análisis del cambio uso del suelo. Mexico City: Instituto de Geografía, Universidad Nacional Autónoma de México.
- MOTA VILLANUEVA, J.L. (Ed). 2005. *Taller: Análisis de los Alcances de la Certificación Forestal en México, Memoria, 9-13 de Noviembre de 2004, Durango, Durango, Mexico*. Mexico City: WWF and Comisión Nacional Forestal (CONAFOR).
- WUNDER, S. 2006. The Efficiency of Payments for Environmental Services for Tropical Conservation *Conservation Biology*, Vol 21 (1): 48-58.
- ZBINDEN, S. and LEE, D.R. 2005. Payment for Environmental Services: An Analysis of Participation in Costa Rica's PSA Program, *World Development*, 33(2): 255-72.