15 Amazon Forests at the Crossroads: Pressures, Responses and Challenges

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Abstract: The Amazon basin and its rich forest has inspired much debate about its natural treasures, potential for economic development and the rights of its populations to exclusive benefits. This debate started in the 1970s and has continued ever since. The chapter points to some of the current key social, occupational and political dynamics in the region and reviews the prime threats affecting Amazon forests and livelihoods. Among these are cattle ranching, soybean production, logging, infrastructure expansion, and the oil and gas industry. These sectors have changed over the years and have adapted to a new economic, political and social climate. The chapter subsequently reviews a series of more recent responses to these threats. Important progress has been made in institutional overhaul, land tenure reform, decentralized government and deregulation and incentives to support sustainable forest use, in particular the newly emerging REDD initiatives. The final part of the chapter provides a balanced assessment of conflicting interests, persisting threats and response options that have achieved positive outcomes suggesting that both old and new challenges require innovative policy action.

Keywords: cattle ranching, decentralization, deregulation, forest devolution, forestry industry, forest policy, infrastructure expansion, land use change, population dynamics, soybean production

15.1 Introduction

The Amazon basin covers 6.5 million km^2, of which 5.5 million km^2 are forests. The population of the "greater Amazon", the area that covers the Amazon watershed and its contiguous area of influence, is estimated at 33.5 million inhabitants [1)], of which 21 million live in cities (UNEP 2009). The forested part of the region is national territory to nine countries. [2)]

This shared territory, furthermore, has multiple vegetation types, including rainforest, flooded forest, seasonal forest, deciduous forest, and savannahs. Today, many people depend on these forests for their livelihoods and evidence of ancient settlements reflected in contemporary vegetation features suggests that this has also been true historically (Balee 1999).

The Amazon forests are recognised for their importance as carbon stocks and for their contribution to greenhouse gas emissions through ongoing deforestation. The same forests constitute a global repository of biodiversity, and other above and below ground natural resources, like minerals and fossil fuels. A significant number of people depend on these forests for their livelihoods. In many parts of the basin, evidence of ancient settlements has been found that is reflected in contemporary vegetation features (e.g., Balee 1999). The region is of much interest to national governments for national development

[1)] The UNEP (2009) population actually provides two different figures for the Greater Amazon population: 38.7 million (p. 67) and 33.5 million (p. 176).

[2)] Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Surinam, and Venezuela. All these countries, except French Guyana, are members of the Amazon Cooperation Treaty Organization.

objectives, and to the private sector for business opportunities. Each of the Amazonian countries has its own set of interests that do not necessarily coincide with the interests of neighbours.

There is a renewed and urgent concern about the future of the Amazon region, the integrity of its forests and other ecosystems, and the well-being of its rural populations, especially the indigenous and other traditional populations. This concern stems from both existing and new threats in a world marked by economic crisis, climate change, and security issues. Economic growth, albeit temporarily slowed down by the recent global crisis, contributes to infrastructure and energy crop expansion (Rumrrill 2008, UNEP 2009). Climate change increases the forests vulnerability to fire and threatens the habitats of endemic species (Malhi et al. 2008). Remote corners and border regions between some countries are the terrain where illegal trade flourishes, sometimes in collusion with insurgent groups. Moreover, an increasingly polarised political climate – epitomised by tensions between Venezuela, Bolivia, and Ecuador, which share pro-social development aims and Colombia and Peru, which prioritise free trade-oriented economic growth – further complicates the process of finding regional solutions to common problems.

On the ground, however, many forces continue to shape the Amazon region. Deforestation, land degradation, poverty, and violence around land appropriation persist. Investments and infrastructure expansion continue, and many regulatory policies are ineffective, because institutions and law enforcement are weak. While well-intended efforts from state agencies and other external actors take into account the local population's needs and aspirations, powerful groups with commercial interests unevenly influence decisions about public and private investments. Efforts to conserve forests and enhance local people's livelihoods conflict or only partly coincide with agrarian development, timber sector expansion, and mineral resource exploitation.

Positive trends are also noted. Indigenous people and traditional communities have increased their territorial control since the 1990s, and forest and biodiversity conservation efforts have expanded. Some of these efforts successfully build on customary community or household forest management (e.g., Sabogal et al. 2008). Urban centres have grown and provide new markets for rural producers. Incomes in rural areas surrounding urban centres have improved in many parts of the region (e.g., Stoian 2000, de Jong et al. 2001). While the concentration of land and resources in the hands of few continues, groups that contest such plutocratic control over Amazon lands, forests, and resources have increased their demands and profiles.

This chapter takes a fresh look at the current Amazon development pathway and its contributing factors. Are there alternative pathways with potential to improve local livelihoods and ecosystem integrity? How can the institutional and market forces that threaten forests and local livelihoods be influenced? Which policies and implementation strategies are needed to create favourable conditions for forest conservation and the well-being of the people in the Amazon?

To address these questions, section 15.2 of this chapter summarises the region's social and land use dynamics. Section 15.3 reviews the threats to the Amazon forests and forest-related economic activities. Section 15.4 reflects on the possible response options that can address negative or enhance positive outcomes. Section 15.5 narrows these options by focusing on current windows of opportunity to achieve economic, social, cultural, and conservation objectives. Finally, section 15.6 reflects on possible future scenarios for the region and strategies to achieve these objectives.

15.2 Amazonian Dynamics

15.2.1 The Changing Social Landscape

The Amazon, while often still largely portrayed as a vast lush forested land mass, has changed much since it came into the international spotlight in the 1970s. The population of "Greater Amazonia" increased from 5 million in 1970 to 33.5 million in 2007 (UNEP 2009). Since 2000, the average population growth of the region has been greater than the population growth in the countries that hold national territory in the basin. The road network crossing the Amazon has significantly increased; in Brazil, for instance, roads have expanded from 29 400 km to 268 900 km in some 35 years (UNEP 2009). Today it is possible to drive a car from the Pacific coast in Peru, all the way to the Atlantic coast in Brazil. The Amazon forest is no longer a precious natural treasure lying beyond civilisation and nibbled at only from the fringes. Rather, the region is a vibrant social and economic landscape that has peoples, cities, towns, traffic, and trade.

The population increase is the result of high fertility rates, declining mortality, and subsequent waves of accelerated in-migration (Perz 2006). The Brazilian Amazon experienced in-migration of some 850 000 people between 1985 and 1990, primarily into the so-called classical Amazonian states Amazonas and Para, but relatively few to the states with tropical forest frontiers like Mato Grosso, Rondônia, and Acre. In recent intra-census years, migrants constituted around 8% of the population in Bolivia's tropical lowland, 6% in Brazil, 20% in Ecuador, and 11% in Peru (Perz 2006). Many reviews of Ama-

zonian migration suggest that immigrants escape poverty or violence in their region of origin. For instance, migrants from north-eastern Brazil moved en masse into the Amazon following years of serious droughts and hardships. Andean migrants moved into the Peruvian lowlands escaping insurgent violence in Peru (Limachi et al. 2006). Since the late 1960s, government policies, regulations, or development programs have stimulated migration (Binswanger 1991, Browder and Godfrey 1997, Limachi et al. 2006). In Bolivia, for example, the government has actively stimulated migration from the Andes region to the lowlands to provide laid-off mineworkers with alternative livelihood possibilities. Population growth and immigration have increased the diversity of an already mixed rural population. A large number of indigenous groups already shared the rural spaces with groups like caboclos and ribereños, who are the product of historical occupation and mixtures between residents and immigrants. The immigrants of recent decades have added to this diversity of rural residents.

The link between Amazonian-bound migrants and forest cover decline is not direct. Perz (2006), for example, observes a positive link between the number of migrants and forest cover decline in some of the Brazilian Amazon states, but not in others. Migrant population and forest cover decline are not directly linked in Bolivia, Ecuador, and Peru, partly because people settle in cities. Even when considering only rural Amazonian immigration, land use practices adopted by the new residents determine the land cover change to a large degree.

Today, the majority of the Amazonian population resides in urban areas, like Belém, Manaus, Iquitos, Pucallpa, Rio Branco, and Riberalta. The region has 24 cities that have populations over 100 000 inhabitants (UNEP 2009). The bulk of economic activity in these urban settlements is not directly related to natural resource use. A town like Cobija, at the northern Bolivia border with Brazil, for instance, increased from around 10 000 inhabitants in 1992 to 26 000 today. A large part of this increase resulted from migrants from the Andes who took over the trade of consumer goods, boosted by Brazilian buyers attracted by low prices because of a strong Brazilian Real in the 1990s and the "zona franca" status of the Bolivian border towns. In Manaus, a city of 1.7 million inhabitants, the appliance and electronics manufacturing sectors and similar industries employ a significant portion of the labour force.

Expanding urban centres attract rural residents from the hinterlands in pursuit of new economic opportunities or better services. Many immigrants maintain agriculture and forest holdings in the locations of their origin (Padoch et al. 2008). In some cases, forests provide an important income contribution or function as a safety net for city and town dwellers who came from the forested hinterlands. An important part of the immigration into forest-rich rural areas originates in the urban centres, and not only from outside the region anymore. Non-agricultural use of space resulting from the growing urban centres is becoming one additional factor that affects forest cover and forest integrity in the region.

Rural life in Amazonia is also subject to change, as schools and health posts are being built in the most remote villages. The region holds 420 indigenous groups, and some of them continue to increase in numbers. At the same time, however, traditional community bonds weaken and native languages go extinct as the indigenous inhabitants become absorbed into the dominant society. The rural population in general scores poorly on income, health, and education indicators. However, in all countries, these indicators have improved, although generally not as much as in urban centres (UNEP 2009).

15.2.2 Occupation and Land Use Change

The Amazon holds the largest continuous tropical forest in the world, but it has also lost the greatest extent of forest among all tropical regions. According to the FAO (Food and Agricultural Organization of the United Nations) Forest Resources Assessment (FRA), the total deforested area in the Amazonian countries was about 3.5 million ha/year in the decade 1990–2000, and it increased to 4 million ha/year from 2000–2005 (FAO 2005). According to the same source, the highest annual deforestation rates during the first half of the 2000 decade were in Ecuador (1.67%), Brazil (0.63%), Venezuela (0.59%), and Bolivia (0.45%). About 78% of the total deforestation from 2000–2005 took place in Brazil. Information from the Brazilian National Institute of Spatial Research shows that annual deforestation in the Brazilian Amazon was relatively high in the early 1990s, decreased to 1.3 million ha in 1997, increased to 2.7 million ha in 2004, and once more declined to 1.2 million ha in 2008.

Both FAO and INPE (Brazilian National Institute of Spatial Research) datasets only report on deforestation, thus ignoring forest regeneration and its potential environmental benefits. Skole and Chomentowski (1994) reported 30% of the deforested area in the Amazon to be regenerating into secondary forest. Lucas and colleagues (2000) support this figure and argue that one-third of the deforested area under forest regrowth is detected. More than a half of this forest is estimated to be less than five years of age. It is also likely that secondary forest succession differs significantly throughout the region (Moran et al. 1994).

Bruno Locatelli

Photo 15.1 Some of the deforested area is reported to be regenerating into secondary forests. Secondary forest in Norte do Mato Grosso, Brazil.

Studies have reported that deforestation was concentrated in a few specific areas in the Amazon (Skole and Tucker 1993, Alves 2003). For example, in Brazil, most deforestation takes place in the so-called "Arc of Deforestation," which reflects a logging and agricultural frontier expansion. In lowlands Bolivia, most forest removal has taken place in the area labelled "expansion zone" in the department [3] of Santa Cruz. In Peru, most deforestation takes place in the Amazon region close to the Andean mountains in central Peru. A closer look into these areas reveals a multiplicity of social, economic, and ecological interactions. Different dynamics can be observed in southern Para, northern Mato Grosso, Rondônia, and Acre, but also in lowland Bolivia, Eastern Peru, Ecuador, and Colombia.

In Brazil, for instance, land occupation patterns vary considerably from state to state. Southern Para began to be occupied in the early 1960s, partly as a result of fiscal incentives and subsidised credits that promoted large cattle estates on public lands. A road network connecting Para to the Belém-Brasilia highway allowed small farmers to move into the area and escalated often violent struggles for land. Mato Grosso state, in the southern part of the Arc of Deforestation, has one of the most active livestock and agricultural expansion frontiers in the Brazilian Amazon. The agricultural and cattle frontier expands further into the center-western Brazilian states. The proximity to national markets of the southern states of Brazil has boosted soybean cultivation in Mato Grosso. The federal government stimulated smallholder settlements in Rondônia as part of a broader strategy to occupy the Amazon region in the 1970s. A large number of the migrants who settled in this state were lured by the promise of cheap land and services for agricultural production. Since the early 1980s, when the road linking Rondônia with south Brazil was paved, migration accelerated further. The provision of rural credit by the state has led to the establishment of more farms over the last two decades. The inflow of migrants to Acre has been relatively low due to the remoteness of southern markets, and rubber tappers resisted cattle ranchers and have lobbied for the creation of extractive reserves since the late 1980s.

Similar contrasts in regional dynamics and deforestation can be observed in Peru. Until the 1990s, most forest conversion took place in the central Peruvian Amazon regions adjacent to the Andes. Especially San Martin, but other neighbouring departments were also targeted by aggressive agricultural development projects, infrastructure development, and related migration (Limachi et al. 2006). High prices for coffee and cotton in response to international demand, as well as national development aspirations, drove these developments. Deforestation in the department of San Martin increased exponen-

[3] Department or *departamento* in Spanish is the first level administrative subdivision of the national territory in Bolivia and Peru.

tially between the 1960s and late 1970s. Since 1983, the deforestation of new areas almost stopped because of shifts to irrigated rice production. Deforestation briefly increased due to coca production between 1987 and 1989. Since 1993, deforestation appears to have declined again (Limachi et al. 2006). In contrast, the Loreto region in the north has shown little deforestation even after the construction of a road from its capital Iquitos, which itself is isolated from the national road network, to Nauta. Deforestation in the southern region of the Peruvian Amazon is much higher. The Madre de Dios department is the location of the Peruvian section of the highway connecting the Pacific and Atlantic coasts. In April 2009, 75% of that road was paved, and traffic and land occupation are expanding rapidly, announcing the beginning of a new agricultural frontier era in the southern Peruvian Amazon. While Loreto has been spared from dramatic land use changes, infrastructure plans, which also target the northern Peruvian Amazon, are likely to change that in the near future.

In the Bolivian lowlands, land-use change, and thus forest removal, has been driven by oil exploration and road expansion. The latter, accompanied by colonisation programs and incentives to stimulate the production of some crops (i.e., sugar, cotton, beef, and rice), led to the expansion of the agricultural frontier into forestlands in the early 1960s. Yet, deforestation was relatively low, about 80 000 ha/year during the early 1980s, because of the small domestic markets for agricultural produce. The adoption of free-trade policies in the mid-1980s accelerated deforestation, as it boosted soybean expansion and cattle ranching (Pacheco 1998). As a result, estimates in the Bolivian lowlands suggest that annual deforestation is growing rapidly from 225 000 ha during 2001–04, to above 300 000 ha (Killeen et al. 2007).

15.2.3 Policies Affecting Land and Forest Resource Use

Land occupation, logging, and other activities that affect forests and livelihoods in Amazonia are strongly influenced by national policies. These policies have evolved over the last few decades, but have also become more complex since the late 1980s, when economic benefits, conservation, and residents' rights and rural well-being became competing objectives.

Land and forest use in the Amazon has primarily been influenced by central government policies with a focus economic growth. Already in settlement programs of the 1970s and 1980s, cattle ranching in Brazil and agribusiness expansion in Bolivia and Peru were promoted through tax and subsidy policies (Margulis 2003, Muchagata and Brown 2003, Brown and Purcell 2005, Hecht 2005, Salisbury and Schmink 2007). Rural development policies rewarded deforestation with land titles (Andersen and Granger 2007), ignoring environmental consequences (Bunker 1984).

Since the 1990s, governments have significantly improved the legal and institutional frameworks that deal with land and forest use in Amazonia (UNEP 2009). These reforms, however, continue to give priority to the timber sector and favour logging entrepreneurs. Only during the last decade, land and forest policies begun to consider small-scale farmer needs. Communities, for example, have been encouraged to participate in logging activities. However, the policies and legislation that regulate community forests inappropriately overlie models implemented by commercial enterprises without considering the specific characteristics of rural communities, such as the absence of capital to invest in logging activities. Countries, such as Peru and Bolivia have banned chainsaws for timber processing, although they represent one of the few low cost technologies to which smallholders have access (Pacheco et al. 2008). Governments often argue that chainsaws waste more timber than sawmills, but this argument does not seem to hold. In various countries where communities have been given preferential access to or ownership over the forest, communities have signed timber exploitation contracts with timber enterprises. Frequently, the conditions of these contracts are unfavourable for the communities, whereas the enterprises have cheap access to timber (e.g., Benneker 2008, Cronkleton et al. 2008). Communal forestry under conditions of market regulations imposes high transaction costs on communities, reducing their opportunity to comply with the legal system and their capacity to negotiate.

While law enforcement is minimal, compliance is also low because the costs of complying with state norms render many forestry enterprises unprofitable. This is especially the case for indigenous and peasant groups who, in most cases, cannot benefit from opportunities under legal and policy revisions. As a result, informality becomes more efficient to regulate social and economic interactions among forest users (Ruiz 2005).

Some countries, however, have managed to simplify forest use regulations to reduce the bureaucratic burden for smallholders to obtain lawful forest user rights. In Ecuador, for instance, simplified forest management plans have been established. In Peru, three different levels of logging intensity can be authorised, with the aim of making communal logging a more simple administrative process (Taylor 2006, Ibarra et al 2008, Sabogal et al. 2008). However, while community forestry is widely promoted, it is hardly contemplated in forest policies (Pacheco et al. 2008). Some non-sectoral policies, however, also have had important impacts on the viability of com-

munal forestry; for instance, those that regulate property rights to land and forests, and policies related to infrastructure development, agricultural development, and settlement (Pokorny et al. 2008).

Agricultural policies generally tend to discourage community forestry, as they encourage agricultural production tolerating or even promoting forest conversion. This often implies extending the agricultural frontier into forested land. Environmental policies consist predominantly of management restrictions or outright bans on forest use, e.g. in protected areas. Forest authorities, often linked to environmental ministries, tend to do little to separate forest from environmental control policies. Last but not least, commercial and communal forestry alike, are affected by macroeconomic factors and policies. For instance, exchange rate policies have a direct outcome on the competitiveness of timber exports; monetary policies influence national consumption of forest products (which is important for Brazil with its high domestic timber consumption), and tax policies have a direct influence on community forestry since they affect product prices and profit margins (Pokorny et al. 2008).

15.3 Threats to Amazonian Forests and Livelihoods

15.3.1 Cattle Ranching

Cattle ranching continues to be one of the most important direct causes of deforestation in the Brazilian (Margulis 2003) and Bolivian (Pacheco 2006) Amazon. Medium- and large-scale cattle ranchers are the main forest converters, although the expansion of pasture for cattle ranching is also taking place in small landholdings, particularly in Rondônia state and along the Trans-Amazon Highway in Brazil (Veiga et al. 2001, 2004). Meanwhile, some authors suggest that extensive cattle ranching in the Amazon is intensifying (Faminow 1998, see also Simon and Garagorry 2005).

In the Brazilian Amazon, non-forest-based productive activities have been widely promoted. Subsidised credit and tax exemptions were implemented during the 1970s and 1980s, and they stimulated corporations from outside the region to convert forests for extensive cattle ranching (Binswanger 1991). Some USD 300 million per year was allocated for such purposes between 1971 and 1987 (Schneider 1995). In 1988, after growing criticism, the use of fiscal incentives to finance extensive cattle ranching in the Amazon was suspended.

The credit program that has provided most credit to farmers in the Amazon is the Constitutional Fund to Finance the Northern Region of Brazil. The program has operated since 1988, under the administration of the Brazilian Bank for the Amazon (BASA 2002). About USD 139 million annually of subsidized credits for productive activities were given out to farmers over a period of 11 years. Equal shares of roughly 40% of these resources were invested in small and medium to large scale beef cattle operations (Arima et al. 2005). The availability of credit is considered one of the main reasons that enabled the expansion of pastures particularly among capital constrained smallholders (Veiga et al. 2004, Arima et al. 2005).

Cattle ranching however, expanded even in the absence of state subsidies (Camargo et al. 2002). The rapidly expanding markets for Amazonian beef in the region (Kaimowitz et al. 2004) and the availability of improved pasture management technologies helped to make cattle ranching a profitable activity in its own right. Cattle ranching is attractive for small farmers because land is cheap and once established, extensive pastures require little labour and capital inputs; cattle herds are also commonly seen as living insurance against health and other risks. Smallholders thus face few entry barriers to cattle production (Hecht 1992, Kaimowitz 1995, Sunderlin and Rodríguez 1996, Walker et al. 2000), which, in addition, inhibits spontaneous forest regeneration and integrates well with smallholders swidden fallowing practices (Vosti et al. 2000). Large landholders have similar reasons to prefer cattle ranching, and they often lack alternatives for investing their profits (Hecht 1993, Kaimowitz 1995, Faminow 1998).

15.3.2 Soybean Production

An unprecedented expansion of soybean production has taken place near the southwestern borders of Mato Grosso and in the Bolivian lowlands in the western Amazon. Between 1990 and 2007, soybean plantations in Mato Grosso increased from 1.55 to 5.07 million ha (IBGE 2008). In Bolivia, the production of soybeans took off in the late 1980s. Soybeans plantations grew from 200 000 ha in 1991 to 940 000 ha in 2005 (INE 2006). After the legalisation of genetically modified soy in 2005, further expansion is likely.

During the early stages of soybean development, incentives to invest in soybean production grew as road-building improved access to markets in areas with relatively cheap land, e.g. in Mato Grosso (Sbragia 2006), Brazil and Santa Cruz, Bolivia. Here, landholders also benefited from adapted seeds and production technologies leading to the introduction of soybean in the cerrados, while retaining high-yield

Bruno Locatelli

Photo 15.2 Brazil, Bolivia and Peru are important timber producers. However, illegal logging continues to be rampant in these countries and the policies to curb it have not been enforced or effective.

potential (Kaimowitz and Smith 2001). Fearnside (2001) suggests that the rapid uptake of soybean production in the Brazilian Amazon was driven by access to cheap agricultural credit for seeds, agrochemicals, and land machinery. In Bolivia, soybean producers previously benefited from World Bank loans (Baudoin et al. 1995), and currently from subsidised fuel, which lowers production costs (Pérez 2007).

In Santa Cruz, Bolivia, Brazilian soybean companies actively contributed to opening the agricultural frontier. They were attracted by low land prices and, in the late 1980s, by the opening of the "expansion area" into the most productive lands in the Bolivian lowlands (Pacheco 1998). Soybean cultivation also expanded because of growing international demand from Asian markets for animal feed. Brazilian producers focused on Chinese markets (Nepstad et al. 2006), while Bolivian farmers targeted Peru and Colombia, benefiting from the reduced tariffs for members of the Andean Community (Pérez 2007).

There are some uncertainties regarding the contribution of soybean expansion to deforestation. In Brazil, while a portion of soybean expansion leads to direct deforestation, another portion occurs in degraded pastures or other land already deforested. The area of tropical high forest converted directly to large-scale crop production in Mato Grosso ranged from only 78 500 to 215 000 ha per year during 2001–2004 (Morton et al. 2006). On the other hand, soybean expansion into pasture lands pushes cattle towards the forest frontier (FBOMS 2005). In Bolivia, soybean expanded into deciduous forest and, more recently, into tropical high forest in northern Santa Cruz (Hecht 2005) and constitute the main direct cause of deforestation in the Bolivian lowlands (Pacheco 2006, Killeen et al. 2007).

15.3.3 The Logging Industry

In Brazil, Bolivia, and Peru, the timber industry has continued to thrive and remains an important player in the forest policy arena; as such, timber companies often interfere with the forest activities of other actors. Persistent illegal logging suggests that the sector will remain outside of effective control and monitoring for the time being. A case in point is Brazil, which authorised 14 million m^3 of timber to be logged in 2004, while that year saw an actual production of 24.5 million m^3 (Barreto et al. 2006), about two-thirds of which was consumed domestically. Since signing the new forest law in 2006, Brazil has introduced the concept of national forests and expects to designate 50 million ha as national forests by 2010 (Freitas and Hummel 2007).

The timber sector in Bolivia has shown remarkable ups and downs, concurrent with the country's political and economic trends. The country's timber industry expanded significantly in the 1970s, when

tropical forests became accessible because of oil exploitation. The following nationwide economic decline negatively affected the timber sector. The adoption of neoliberal economic policies revitalised the timber sector. Timber extraction was based on selective logging of a few species, did not consider any forest management practices, and no monitoring took place. During the late 1990s, Bolivia's timber production declined drastically because of a regional economic crisis and also because of the new, stricter forest regulations. However, the sector has recovered and in 2005 Bolivia produced 826 000 m^3 of timber (SF 2007).

The timber sector in Peru had mostly collapsed by the beginning of the 1990s, when insurgent groups gained control of access routes to timber-rich forests. Since the insurgency has been quelled, the industry has rebounded, but with little effective regulation or control. The new forest legislation assigns exploitation rights based on public bidding with an area-based fee and under strict management and administrative rules. However, the enforcement of forest regulation is minimal, and a vast proportion of Peru's timber is from illegal sources (Hidalgo 2003, Smith et al. 2006, Colan et al. 2006/2007).

In Bolivia, more forest land has been given to indigenous groups and peasant communities, and less forest has been granted to forest enterprises, which pay higher forest use fees. This has resulted in less revenue that could be used to finance auditing and monitoring by state agencies and municipal governments, and has affected the government's ability to control illegal forest use, a trend that has continued under the Morales government (Contreras-Hermosilla et al. 2002).

More than any of the sectors reviewed here, the timber industry suffers from lack of adequate governance. Illegal logging is rampant in Peru, Brazil, and Bolivia. Barreto et al. (2006) suggest that 40% of Brazil's production is illegal, and most experts estimate that 90% of the timber from the Peruvian tropical lowlands is logged illegally. Illegal logging goes largely unpunished, which is why the two prime ingredients of the current approach to forest conservation, namely environmental legislation and establishment of protected areas (including extractive reserves, indigenous territories, and regional conservation areas) remain ineffective. There has been interest and some progress towards transferring logging rights to communities, which has the potential to lower logging impacts because forest communities generally have more interest in conserving forest stocks and often their logging operations are not mechanized. But, even where forest access and property rights are favourable for community engagement, the administrative and technical requirements often force communities to turn to companies to develop and implement the forest management plans on their land. Communities that depend entirely on timber enterprises for capital input generally end up with unfavourable timber sale contracts, in terms of the price they get for the timber, the control they can exert on logging activities, and the long duration of these contracts (Medina et al. 2009). Communities that have received financing for the development of their management plan from a third party, e.g., the government or non-governmental organisations (NGOs), have a better chance to engage in more equitable timber sale contracts with private enterprises (Benneker 2008). An additional shortcoming of the timber industry that also needs addressing is technical inefficiency and resulting excessive waste and damages caused by logging.

15.3.4 Infrastructure Expansion

Under its National Integration Plan, Brazil built the first major roads into the Amazon region during the 1970s to improve access to raw materials for national industries and boost export earnings. Road construction went together with massive re-settlement programs (Bunker 1984). In Peru, the first significant road into the Amazon was finished in 1943. Amazonian colonisation projects started, however, only in the 1970s (Limachi et al. 2006). Spontaneous migration followed the expansion of roads, spurred by a desire to escape poverty and violence in regions outside the Amazon. In Brazil, many families moved in from the poor northeast; in the Andean countries, families resettled from the mountainous regions also to escape poverty (Limachi et al. 2006).

Collectively, the South American countries that share the Amazon region have major plans to expand the road network into the Amazon basin. The "Initiative for the Integration of Regional Infrastructure in South America" (IIRSA) program was launched in 2000. It consists of plans for 335 highway projects, bridges, dams, ports, waterways, natural gas pipelines, electricity networks, and telecommunications improvements (Killeen 2007). The total program represents an investment of nearly USD 38 billion, with technical and financial support being provided by multinational financing agencies. The bi-oceanic highway that connects the Pacific and the Atlantic from Peru to Brazil and passes close to the northern Bolivian border, and a natural gas pipeline from the Caribbean coast in Venezuela to the Rio de la Plata estuary between Argentina and Uruguay, are likely to have great impacts in the region.

Killeen (2007) predicts important environmental and social impacts, and positive outcomes are not evident. Other observers claim that the program essentially reinforces the expansion of monocultures and other allegedly unsustainable economic models

at the cost of forests without bringing about expected economic benefits, such as job creation (Valente 2009).

The Brazilian equivalent of IIRSA was the so called Avança Brasil program, which involved ambitious plans to build approximately 7500 km of highways, railways, waterways, and hydroelectric dams into the Amazon, from 2000–2007 (Fearnside 2006). Avança Brasil aimed at improving the well-being of the increasing Brazilian population through gross domestic production (GDP) growth from agriculture, forest use, and mineral resource exploitation in the Amazon. The program has also been linked to International Monetary Fund (IMF) recommendations to increase export earnings and facilitate foreign investment. Elements of Avança Brasil now continue to be implemented by the Lula Government under the Growth Acceleration Program (PAC). Some authors argue, however, that environmental lobbies have grown stronger and, albeit far from outweighing economic interests, now contribute to shaping the wider policy landscape, at least in the Brazilian Amazon (Lemos and Roberts 2008).

Nonetheless, even if infrastructure development must not necessarily result in deforestation (e.g., Andersen et al. 2002), empirical evidence from the Amazon leaves no doubt about roads as drivers of forest loss (Pfaff et al. 2007). In the absence of competitive economic alternatives and the rule of law, roads attract poor migrants and commercial interests searching for valuable timber and land for agriculture (Fearnside 2006). Soares-Filho et al. (2006) estimate that without significant improvements in environmental governance, road network expansion in the Amazon will lead to the loss of 40% of original Amazonian forests by 2050, mainly in Brazil.

15.3.5 Oil and Gas Exploitation

Oil exploration and exploitation has been a part of Amazonian resource pursuit since the 1920s (San Sebastian and Hurtig 2004). In Peru, for instance, Amazonian oil drilling started in 1939 (Hoy and Taube 1963) and has continued to expand since. Even though millions of hectares were already under concession during the mid-1950s, exploitation lagged behind, in part because of technical difficulties and also because of economic and political instabilities (Hoy and Taube 1963). Since the 1990s, oil and gas exploitation in countries of the western Amazon has picked up drastically. Ecuador, one of the poorest countries in the region in the 1970s, now generates 40% of export earnings from oil exploitation, primarily in its Amazon territory (San Sebastian and Hurtig 2004).

There are multiple impacts of the oil industry. Chirif and Garcia Hierro (2007) and San Sebastian and Hurtig (2004) cite reports of pollution from heavy metals, chlorides, and other contaminants that result from dumping large quantities of oil residues, drilling water, and drilling slick into rivers or open-air pits. They estimate that in Ecuador alone, between 1972 and 1993, some 114 billion litres of toxic waste were dumped on land and in waterways. Frequent spills from various pipelines that move crude and processed oil contribute to the contamination. The contamination results in excessive levels of cadmium and lead in the bloodstreams of people living in areas downstream from oil exploration (Chirif and Garcia Hierro 2007). Fish, a principal protein source for large numbers of Amazonian inhabitants, absorb toxic levels of contaminants, and cattle that consume contaminated river water regularly die (San Sebastian and Hurtig 2004).

The pollution described above is the result of poor practices, inadequate environmental standards, and poor supervision and monitoring. Fortunately, regulation and supervision by the resident population and others (Chirif and Garcia Hierro 2007) have increased. Oil companies have equally become more concerned about meeting environmental standards and in the future, impacts of oil exploitation are likely to diminish.

Given the already extensive areas under oil concessions in Ecuador, and the recent expansion in Peru, the impact of oil and gas exploitation can be expected to increase. Finer et al. (2008) calculate that some 180 blocks are under concession, cover an area of 688 000 km^2 in the western Amazon, more than 10% of the region's forest. The majority of these concessions is located in Peru, which at present has about 72% of its Amazon territory designated as concessions to oil and gas companies.

An additional negative effect of oil and gas drilling is the opening of roads to access remote forest areas, many of which have protected area status. The Ecuadorian Amazon, for instance, is now covered by a vast network of roads to access the 300 active wells and 29 production camps (San Sebastian and Hurtig 2004). Some 15 indigenous groups in voluntary isolation are being threatened by oil exploration and logging of mahogany in the remotest corners of the Amazon (GITAI 2007). Chirif (2007) foresees the expansion of illicit growing of coca leaves and the preparation of cocaine paste in areas along the Peru-Colombian border, where oil production will provide the materials for coca leaf processing.

15.4 Responses to the Challenges

15.4.1 Institutional Reform

Since the Rio Summit in 1992, national governments, often in collaboration with bilateral partners and the international community, have strongly invested in institutional reforms to improve legal frameworks and strengthen governance capacities. Generally, these efforts were focused on the classic command and control approach, but also included participatory elements to more actively engage civil society in the planning and control of environmentally relevant activities.

Nearly all Amazonian countries in the last two decades have profoundly revised their legal frameworks for the protection and sustainable use of natural resources, particularly forests. Governments at the federal, state, and even municipal levels have set up forestry plans as strategic guidelines to define the principal policies for the use and conservation of natural resources for sustainable development. Often these plans were developed with the active participation of civil society and thereby contributed to awareness and broader acceptance. Initially, reforms exclusively focused on the definition of norms for the elaboration, implementation, and audit of forest management plans carried out by commercial timber enterprises and, for the first time, provided a clear and transparent basis for management and control. Later, governments also started to consider simplified regulations and norms for forest use by communities and individual families, yet still focussing primarily on timber harvesting. Local forest management schemes and the collection of non-timber-forest products still remained widely ignored. Most countries have chosen concession schemes as their governance approach and have set up detailed operational frameworks for authorisation, audit, and control.

Most governments also invested in strengthening the governmental organisations responsible for effective implementation of the new regulations. This mainly included three specific actions: (1) the establishment of competent governmental organisations and departments, such as environmental ministries and forest services; (2) investments in technologies for environmental control, particularly remote sensing and auditing, as well as capacity building; and (3) decentralisation of competences from the central government to the state, and occasionally, municipality level. These efforts strongly affected the power relationships and logistical settings for forest management. However, in spite of strong international support, the new institutional framework generally suffered from insufficient financial resources and lack of technical capacities (Pacheco 2003, Toni and Kaimowitz 2003, Larson et al. 2006). In some cases, governance mechanisms also considered the possibility for participation so that stakeholders gained some influence in decision-making processes (Ribot 2002).

15.4.2 Land Tenure and Access to Resources

The unclear and often conflictive land and forest tenure situation in the region is generally understood as one of the principal drivers of uncontrolled use of forests and subsequent land degradation. The lack of a consistent rural land register, illegal land-grabbing and invasions, overlap of tenure categories, and the resulting lack of trust and violent conflicts among different actors in the Amazon probably represent today's major bottleneck for all currently available responses to the challenges that the Amazon faces (e.g., Araujo et al. 2009).

Governments, in parallel with their efforts to improve the legal-institutional framework, have tried to implement three measures to address resource tenures: (1) the regularisation of private land tenure, (2) the strategic spatial planning called Ecological-Economic Zoning (EEZ), and (3) the establishment of mechanisms to effectively control public lands. The latter included the demarcation of protected areas.

By the 1980s, social movements had gained formal recognition of customary tenure rights by many governments in Latin America (Hall 2000). In the 1990s, some countries began to grant tenure and access rights to forest areas to indigenous groups and traditional communities. In Bolivia, for example, in 1996, the government created the legal status of community land (Tierras Comunitarias de Origen) and recognised communal properties of up to 500 ha per family in forest communities in the northern Amazon. Brazil demarcated huge forest areas as extractive reserves and as several other forms to recognise customary property rights. Similar forest tenure changes took place in Peru and Colombia (Chirif and García Hierro 2007). In Colombia, black communities obtained formal recognition of their lands in the so-called "resguardos" in the Pacific coast, as did the indigenous populations located in the Amazon region in the southeast portion of the country (Fajardo 2002). Up to now, approximately 197 million ha have been formally titled or are in the process of formal recognition to favour indigenous populations in the Amazon as a whole, which corresponds to 25.3% of the territory (RAISG 2009). Nonetheless, intra-village conflicts over access to land under communal control sometimes persist.

Several Amazonian countries have refocused on land use planning to better control actors operating in

the region. Brazil launched its National Forestry Plan in 2000 to coordinate government actions addressing the country's forests. In response, governments at all levels began to coordinate with the National Forestry Plan and developed strategic spatial plans – refered above as EEZ – to determine land use options and restrictions for specific areas. With the involvement of different stakeholder groups, EEZ built awareness about possibilities and difficulties of rural development. The identification and demarcation of public lands and the subsequent definition of their legal status simplified the huge array of locally specific land use categories.

15.4.3 Decentralisation and Deregulation

The forestry agencies in the countries that share the Amazon region have traditionally been highly centralised and allowed little stakeholder participation. This system allocated forest resources inefficiently and created high levels of corruption in the collection and distribution of stumpage fees. Attempts to reverse that situation were made in the 1990s, when some countries (e.g., Bolivia) began to promote reforms to decentralise decision-making regarding policy formulation and public investment. While early decentralisation reforms primarily involved the provision of health and education services, they gradually began to include forest resource management. Some decentralisation took place in Ecuador and Peru in the late 1990s. In Brazil, environmental responsibilities were transferred to the states only in the early 2000s.

The arguments favouring administrative decentralisation stressed the inefficiency of central government in allocating public resources to meet local people's needs, and the need to shrink public administration in the face of smaller public budgets. The argument against decentralisation was that transferring responsibilities to lower levels of government would only spread corruption of public officials to states and municipalities, and that decision-making would likely be captured by local elites (Ribot 2002). Results seem to confirm both arguments. In some cases, municipalities have indeed engaged in sustainable forest management linked to territorial planning, and provided support to communities. In other cases, decentralisation has reinforced the role of local elites and boosted predatory forest exploitation (Gibson and Lehoucq 2003, Pacheco 2004, Larson et al. 2006). Furthermore, in many cases, local governments receive only a small share of public resources, which limits their enthusiasm to become more active players engaging in their new role (Andersson 2002).

In most of the countries where decentralisation has occurred, it has been accompanied by reforms in forestry regulations aimed at promoting sustainable forest management, such as requiring reduced impact logging (Pacheco et al. 2008). Yet the forestry norms developed as part of the new forest policy frameworks have, to a large extent, adopted a model of large-scale commercial logging. The same norms and standards are applied to local forest users, including indigenous people and smallholders. Thus, the model introduced new rules of the game for forest resource extraction that have been difficult for local forest users to implement (Pokorny and Johnson 2008).

Some countries are now addressing these issues. In Ecuador, the government has experimented with simplified forest management plans that apply uncomplicated rules for identifying and selecting trees to be logged. Approval of these plans is now the responsibility of the provincial government instead of the central government (Ibarra 2008). In Brazil, a distinction is made between high- and low-intensity plans, but both are subject to the same bureaucratic procedures that increase transaction costs. In all cases, forest management plans must be approved by a professional forester and, in community areas, plans have to be approved by leaders representing the community (Carvalheiro 2008). In Bolivia and Peru, little progress has been made towards simplifying management plans, although there has been a strong debate about the need to simplify forest regulations that discriminate against communities and smallholders. There is also an ongoing discussion in Bolivia, Brazil, and Peru to promote self-regulation as an alternative to cumbersome and onerous forestry regulations.

15.4.4 Reducing Emissions from Deforestation and Forest Degradation

The prospect of including forest conservation measures as eligible mitigation options under the post-2012 international climate policy regime has provoked unprecedented international donor commitments to plans to mitigate deforestation and forest degradation in tropical countries. Brazil, with its largest continuous tropical forest reserves and the highest absolute deforestation rates in the world, has attracted a major share of recently earmarked funds for reducing emissions from deforestation and forest degradation (REDD).

While the design of an international REDD mechanism is still being negotiated, two questions seem pertinent: Can it be expected that REDD will significantly reduce tropical deforestation? If yes, who will be the winners and losers? The combination of factors that drive deforestation in the Amazon

leaves little doubt that business-as-usual is unlikely to substantially curb forest loss during the coming decade. As evidenced above, the present institutional and policy setup in most Amazon countries provides strong economic incentives for agricultural expansion. The ambitious environmental and forest conservation policies of many governments have done little to discourage deforestation on the ground, apart from declaring most of it de jure illegal. To make a difference, REDD must change the current mix of incentives, not only in terms of direct economic signals, but also with regard to the underlying institutional determinants of land use decisions in the Amazon.

To illustrate the REDD challenge, consider that the Brazilian Amazon features a population roughly equivalent to that of the metropolitan area of the city of Sao Paulo, yet scattered across 5.2 million km^2. Little more than 4% of private landholders, the major contributors to deforestation in the Brazilian Amazon, have their lands regulated to the extent necessary for effective implementation of existing command-and-control policies (Barreto et al. 2008). This means that offenders need to be caught with a "running chainsaw" in order to duly enforce conservation laws. In practice, the same applies to the region's 2 million km^2 plus of protected areas and indigenous territories. Running on an annual operational budget of roughly USD 50 million, Brazil's environmental protection agency IBAMA has few alternatives other than to rely on deterrence mechanisms, such as very large fines and showcase interventions.

Many REDD proponents point to the potential of direct payment-based approaches as effective means to encourage forest conservation. No doubt, as long as forests have no or little value to local land users, conversion to agriculture will remain the preferred option unless more rigorous law enforcement prevents this from happening. The latter would imply substantial economic losses for virtually all segments of the rural population, except for certain ethnic traditional and indigenous minorities, including powerful commercial interest groups (Börner et al. in press). This is most likely the reason that many laws have remained on paper so far.

The lion's share of REDD funds will likely be administered by governments that receive transfers conditional on the reduction of deforestation rates. Norway's USD 1 billion offer for Brazil's Sustainable Amazon Fund is a prominent example. If policy makers are to achieve a sustainable deal with society, they will have to combine sticks with carrots to compensate for the substantial opportunity costs of maintaining forests in place of agricultural expansion and timber extraction (Wunder et al. 2008). The major bottleneck is the lack of institutional mechanisms to deliver both sticks and carrots effectively, most importantly regulated land tenure and tenure reform, effective property rights enforcement, and improved access to technological and economic alternatives to extensive land uses. Without these basic preconditions, REDD funds run the risk of vanishing into black holes, or worse, doing more harm than good.

15.5 The Way Ahead

The Amazon region is known for the mighty river that crosses the continent from west to east and for the world's largest continuous tropical forest. Meanwhile, the region is undergoing rapid changes: Scattered in vast forest tracts, large urban centres have evolved, and expanding road networks make the forest margins ever more accessible. The Amazon's rural dwellers have heterogeneous cultural backgrounds, engage in diverse livelihood strategies, and these put different values on natural resources.

This chapter merely touches on the most recent natural and social transformation processes in a region constantly affected by global pressures. Exactly one century ago, global demand for rubber resulted in a "boom-and-bust" cycle with transformational consequences for local economies in the Amazon. Today, global market preferences for the Amazon's resources have changed, but local ecological and economic impacts remain strong. Yet, interest in the Amazon is no longer limited to timber, agricultural land, oil, and other minerals. Both Brazilians and the global society also increasingly demand the conservation of biodiversity, the forest's climate regulating functions, and the region's water resources. The diverse actors that claim these resources and their benefits have increased in number, and they have become ever more sophisticated in pursuing their claims. Without doubt, improved and globalised knowledge and information benefits all players involved in shaping the Amazon's future. As a result, decision makers are increasingly facing real trade-offs when it comes to planning development and conservation in the Amazon.

Monitoring and enforcement of regulations have vastly improved the ability of authorities to govern resource use and conservation efforts. However, the shocking quantity of illegally logged timber and the harsh reality of unauthorised land conversion and related pollution show that existing capacities are still insufficient to counterbalance unsustainable economic interests in the region.

With the growing international interest in tropical forests, old violent conflicts are back on the political agenda. During 2008/9, Peruvian indigenous groups protested against government policies in the Amazon, including the preferential treatment of corporative interests in oil concessions over much of the Amazonian territory. These protests led to the death

of over 30 people in June 2009. Few countries have yet found satisfactory ways to deal with incompatible economic interests and territorial claims of indigenous groups for recognition of ancestral rights and self-determination. Several observers (e.g., Rumrrill 2008) believe that growing international demand for resources in the Amazon will intensify such conflicts in the future.

Within the scope of this chapter, we can only highlight a few of the complex sets of measures frequently proposed to avoid scenarios of progressive resource exploitation at the expense of ecosystem services and local livelihoods. Chief among much needed policies for the Amazon is the control of illegally expanding cattle and soy production, as well as timber, gas and oil exploitation, and related contamination. Incentives that promote otherwise unprofitable activities need to be removed, and support for legal and sustainable use of forest resources strengthened. Equally important, incentive schemes need to account for the negative environmental externalities caused by extensive natural resource use in most parts of the region. Large parts of the profits made in the forest sector are captured by capitalised entrepreneurs not infrequently supported by corrupt government officials. Few benefits trickle down to the rural population, which often ends up being even worse off because of restricted resource access and environmental degradation. Preferential resource access for local and traditional populations with customary rights seems justified not only on moral grounds, but because accounting for both economic and environmental benefits renders traditional small-scale production at least as profitable as large-scale resource exploitation.

Important improvements can still be made within the governance sphere. Decentralisation of decision making power and participation mechanisms for the local population needs strengthening. At the same time, however, accountability and transparency at all levels, within governments, civil society and the private sector, needs improvement.

Some specific recommendations can be made for individual countries. In Brazil, state governments, indigenous organisations, civil society, and the private sector need to define the future of their Amazonian space. The national government will have to tame the corporate private sector in the Amazon and limit its excessive influence on policy formulation and implementation. Progressive state governments need support in promoting sustainable development models, whereas an end has to be put to corruption at lower administrative levels.

In Peru, the incumbent national government has to revisit its plans for private sector-led Amazonian forestry development and open up to the voices of local grassroots organisations, indigenous groups, and local governments.

Considering the cultural and ecological peculiarities of the Amazon region, regional governments are probably best placed to lead the formulation of the policies that can shape the future for its people. The example of Bolivia, however, shows the importance of mechanisms to ensure that this is the result of democratic and participatory processes. In the Bolivian Amazon, central government opposition has found strong support from the corporate sector, thus again leading to policies being overly dominated by economic interests at the cost of the local population.

An important step towards a locally defined sustainable development path is the continuation of land tenure and recourse access reforms in all Amazon neighbour countries. Tenure reforms need to result in well-defined property rights for local people, granting them de facto decision-making autonomy within the limits of environmental policies. This also implies the recognition of collective and individual tenure claims of established rural communities (Chirif and Garcia-Hierro 2007).

Not at least, research has a role to play in defining the Amazon's future. Interdisciplinary research needs to seriously address the costs and benefits of investment into both economic development and environmental conservation, and consider their social dimensions. A more thorough investigation of the trade-offs between these almost generally conflicting objectives will likely present national governments with surprising evidence indicating that the current mix of public spending is rather inefficient. Such analyses may in many cases influence decisions as to what are more appropriate land use options for major tracts of the Amazon landscape. Sustainable forest management instead of forest conversion may become more attractive, especially if reduced impact technologies, certification, and improved monitoring can guarantee that forest management practices improve. In the presence of clearly defined land and forest tenures, the same cost-benefit analysis may also increase the attractiveness of communal forest management vis-à-vis corporate logging or agriculture (Sabogal et al. 2008, see also Chapter 16).

Research must also contribute to determining how incentives and disincentives are best combined to achieve maximum impact in conservation spending. For example, conservation costs may be too high to be compensated for in areas where economic returns on forest conversion are extremely high, thus leaving few other options than control and enforcement. Meanwhile, enforcement costs may far exceed conservation costs in many vast and remote Amazon areas covered by extensive pasture production or slash-and-burn systems. Under such circumstances, offering conditional compensations for forest conservation may well turn out to be the best strategy. A major challenge that proponents of such transfers

face today is how to make sure that such transfer payments do not vanish into black holes. Whether payments are a result of market mechanisms or targets agreed upon in international negotiations, they should be conditional on delivery of conservation outcomes. Estimates of the full economic costs of achieving additional conservation outcomes, therefore, should and will represent the basis for negotiation of such transfers.

Finally, optimising public spending and providing appropriate incentives for conservation at the local level is not enough for the considerable number of poor dwellers in the Amazon who lack the means and available choices to respond to such incentives. A socially inclusive sustainable development strategy for the Amazon, therefore, requires measures to improve access to knowledge, technology, and markets for goods and capital, the lack of which often represent the root cause of what some authors have called conservation-investment poverty.

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