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Toward a Policy of Sustainable Forest Management in Brazil

A Historical Analysis

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Understanding the forces that drove policy in the past can inform expectations of the effectiveness of policy implementation today. Forest policies of countries with forested frontiers transition through stages of forest management, reflecting the orientation of governments toward economic development. The article follows Brazilian national forest policy from the early 20th century from colonization to protectionism, during which extrasectoral policies largely served to marginalize forest policy. More recently, profound changes in Brazil's governance structures, civil society's progressively important role in influencing policy, and recognition of the biophysical importance of forests have fostered an emerging vision of the Amazon as a region whose primary vocation is sustainable forest management. The sustainable management phase of forest policy development and the approval of Brazil's first Public Forest Management Law, given the current socioeconomic, political, and environmental context, present an unprecedented opportunity for increasing the relevance of forest policy in shaping land use.

Keywords: *forest policy; Public Forest Management Law; forest concessions; Brazil; sustainable forest management*

Understanding the forces that drove policy in the past can inform our expectations of the effectiveness of policy implementation today. Historical analysis suggests that forest policies of countries with significant forested frontiers transition through stages of forest management reflecting the orientation of governments toward economic development on the frontiers, namely, settlement and exploitation, protective custody, and sustainable forest management (Marty, 1986). To present, with respect to Amazonian forests, Brazil's path is no exception from this trend. Our article follows Brazilian national forest policy from its beginnings in the early decades of the

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20th century to the colonization plans and "paper parks" of the military regime of the 1960s to the commitment to sustainable forest management of the current democracy to identify Brazil's path through the stages of forest management. In the past, a prioritization of industrialization and integrating the Amazon into the national economy marginalized forest policy.

More recently, profound changes in Brazil's governance structures, increasing awareness of the biophysical importance of forests and civil society's progressively important role in influencing public opinion and political processes have fostered a vision of the Amazon as a region whose primary vocation is sustainable forest management. Our analysis suggests that the sustainable management phase of forest policy development and the approval of Brazil's first Public Forest Management Law (PFML), given the current socioeconomic, political, and environmental context, presents an unprecedented opportunity for increasing the relevance of forest policy in shaping land use.

This article is structured as follows. The first section offers a brief overview of the settlement and exploitation phase of policy development. The second section considers the protectionist phase of forest policy, focusing on key structural features of Brazil's political economy that challenged effective policy implementation. Bridging the transition to the sustainable forest management phase of forest policy development, we pay particular attention to the effects of democratization in creating political space for an environmental movement that encompassed many socioenvironmental concerns with implications for the forest sector. The third section considers the sustainable forest management phase of policy development and highlights programs and institutions that serve as indicators of this transition, including the approval of Brazil's PFML in 2006. Given the potential significance of this law in regulating public forestland use, we discuss in detail the interaction of variables that facilitated its approval. We conclude with a discussion of key events in Brazil's forest policy development and prospects for effective policy implementation during the current sustainable forest management phase.

Settlement and Exploitation (1889 to 1964)

Early legislation on forests regulated the harvest of valuable species, such as Brazil wood (*Caesalpinia echinata)* and the harvest of areas adjacent to water. Land clearing occurred primarily in the Atlantic Forest Region to meet European demand for forest products, to produce energy, and to establish farms and ranches. With declining timber stocks and the drastic transformation of this countryside, the need to regulate forest use was recognized in the 1920s. The government of Getulio Vargas passed the first Forestry Code in 1934 (Decree No. 23.793, 1934). With this law, private property rights over natural resources were subordinated to the collective interest of society, an imposition that continues to resonate strongly today. A Legal Reserve requirement, still in existence although the requirements have changed,

dictated that no more than 25% of the forested land in private rural properties could be cleared (art. 23). Also, a fact rarely mentioned in current debates regarding logging concessions in Brazilian public forests, the basic framework for forest concessions, the sale of the right to harvest timber on public land, was written into the 1934 code, although they were not implemented during this era. The law was ambitious for the time, but resulted in few substantial changes in forest practices; government priorities were industrialization and integrating the Amazon into the national economy through colonization and agricultural expansion.

A Protectionist Approach to Natural Forests (1965 to 2000)

The transition to a paradigm of forest protection often occurs when unrestricted exploitation of the forests renders them unable to sustain forest industry capacity (Marty, 1986). Legislative command and control mechanisms are believed to be required to renew and protect natural resources. In the case of Brazil in the 1960s, however, though the Atlantic Forest was largely removed or intensely fragmented, the forests of the Brazilian Amazon remained relatively intact (Fearnside, 1980, cited in Siqueira & Nogueira, 2004, p. 5). Brazil's protectionist period was characterized by the promulgation of restrictive legislation, the creation of large protected areas, and the provision of incentives for plantation forests. Initiatives for the development of the natural forest management sector were generally absent.

Although a variety of legal instruments and institutions were put in place, they were largely ineffective in controlling deforestation as the nation's model of resource extraction for economic growth took precedence over the rational use of forest resources.[1] With the poor implementation record of the previous forestry code, discussions about a new forestry code began in Congress in 1948 (Ahrens, 2003; Ondro, Couto, & Betters, 1995). And 17 years later, marking the transition to the paradigm of forest protection, the 1965 new forestry code (Law No. 4.771, September 15, 1965) was instituted by the new military government of Humberto de Alencar Castelo Branco. This code increased the restrictions on private property rights introducing Permanent Preservation Areas (APPs) for the protection of sensitive areas and increased the Legal Reserve requirement in some regions of the country to 50%.[2] The law also created a range of conservation area categories: national, state, and municipal parks; biological reserves for the protection of flora, fauna, and aesthetics; and national, state, and municipal forests for meeting economic, scientific, or social objectives.

The military government's strategy of import substitution industrialization demanded raw materials to feed the nation's industry. Charcoal made from timber was particularly important for the metal and mineral industries (Kengen, 2001; Mery, Kengen, & Luján, 2001). To ensure supply of these products, subsidized credit and tax exemptions for forest plantations were declared in the new code and in a law

passed in 1966 (Law No. 5.106, September 2, 1966). These incentives were the state's principal instrument for forest sector development and resulted in the planting of 6 million ha between 1965 and 1987 when the subsidies were eventually terminated (Sociedade Brasileira de Silvicultura [SBS], 1998, cited in Mery et al. 2001, p. 245).

In 1967, the Brazilian Institute for Forestry Development (IBDF; Decree No. 289, February 28, 1967) was created. Although the IBDF was Brazil's first federal agency charged with the mandate of managing natural resource conservation, given the importance of forest plantation incentives for the nation's industrialization, the agency's main role in practice was the administration of these incentives and the commercialization of wood products (Chadwick, 2000; Drummond & Barros-Platiau, 2006; Kengen, 2001; Viana, 2004).

Integrating the Brazilian Amazon Into the National Economy

Geopolitical concerns including securing Brazil's borders with other Amazonian countries and insuring ownership of mineral and other natural resources motivated government efforts to demonstrate control of the Brazilian Amazon. The military government's Operation Amazonia sought to develop, occupy, and integrate the Brazilian Amazon with the national economy by pursuing major road building and agricultural colonization projects and providing fiscal incentives for industry and agriculture. The Superintendency for the Development of Amazônia (SUDAM) was created in 1966 to manage the strategy with the support of the Bank of Amazonia (BASA; Mahar, 1989, p. 11).

The National Integration Program (PIN) was launched in 1970 and financed the Transamazon and the Cuiabá-Santarém highways, which are now important commercial corridors as well as the foci of severe forest loss and land conflicts. Agricultural settlement in the region was encouraged by allocating land in a 20-km strip on either side of these highways to smallholder colonists. Settlers were lured from the drought-stricken northeast as well as the south of Brazil with the promise of housing subsidies, crop financing, and loans for the purchase of farm plots and housing.

The National Institute for Colonization and Agrarian Reform's (INCRA) model for colonization contradicted sharply with protectionist provisions in the new forestry code. For example, a law passed in 1971 placed all land in the Brazilian Amazon within 100 km of a federal highway or 150 km of an international border under INCRA's jurisdiction. According to INCRA policies, a settler would be granted transferable land titles in this area if they cleared it. Moreover, settlers were offered title to an area 3 times the size of the area cleared, up to a maximum of 270 ha. This policy dramatically accelerated land clearing and speculation in the region (Mahar, 1989, p. 37).

Following the oil crises in the 1970s and the resulting increased demand for foreign exchange, the state placed less emphasis on road building and settlement and instead concentrated on the promotion of large-scale export-oriented projects in

livestock, forestry, and mining around 15 development centers in the Brazilian Amazon (Mahar, 1989). This program, POLAMAZONIA, active between 1974 and 1987, sought to develop infrastructure and increase investment and foreign exchange earnings through fiscal incentives and subsidized credit. The Greater Carajás Program established in 1980 was another such program designed to exploit the reserves of iron ore in the Serra dos Carajás region in the state of Pará (Mahar, 1989).

The military government's strategy for Amazonian development was arguably effective in generating economic growth although inequitable from a distributional perspective. The politic for the forest sector was aligned with the regime's emphasis on industrialization and as such concentrated on the promotion of forest plantations. With the lion's share of public resources devoted to industrialization, resources for promoting the sustainable use of forests were scarce. Institutions charged with forest protection were weak and underfunded, and the protectionist stage of Brazilian forest policy lived out primarily on paper.

The Environmental Movement and Democratization

Political opportunity for the formation of an environmental movement began in late 1974 when the then President Ernesto Geisel's government announced the opening (*abertura*) of the political system to the gradual implementation of democracy. Following the Geisel government, the moderate government of President João Figueiredo declared amnesty for exiles, terminated censorship in the print media, permitted the formation of new political parties, and called for the direct election of state governors (Alonso, Costa, & Maciel, 2005; Chadwick, 2000). This opening enabled the growing environmental movement to partner with established sectors of civil society and align itself with an increasingly organized international environmental movement.

Growth in the number of environmental nongovernmental organizations (NGOs) appears to be correlated with important events in Brazilian democratization. NGO growth increased with the *abertura* in 1974, the amnesty law passed in 1978-1979, and direct elections for state governors in 1982. A record 77 new environmental NGOs were established following the Constitution of 1988 (Chadwick, 2000). Democratization also brought with it new state environmental institutions which were more responsive to civil society's demands—there were 3 times as many in 1995 than at the beginning of the *abertura* (Chadwick, 2000).

In 1981, the National Environmental Policy (Política Nacional do Meio Ambiente, Law No. 6938, August 31, 1981) was instituted and continues to be Brazil's most important environmental regulation. Passed during the *abertura*, the approval of this law provides evidence of civil society's increased presence and effectiveness in influencing policy (Drummond & Barros-Platiau, 2006). The emerging legal-bureaucratic structure provided political space and more responsive institutions for environmental claims as well as career opportunities within those institutions

(Alonso et al., 2005). Furthermore, the environmental movement's shift from a biocentric focus, which aimed to protect nature from human influence, to a socioenvironmental focus in the 1970s broadened the support for this movement.[3]

As the number of environmental organizations grew, so did their ability to coordinate and act collectively. The environmental movement's increasing social orientation enabled it to graft environmental concerns on to other socioeconomic and political agendas, effectively creating linkages between the environmental and democratization movements (Alonso et al., 2005). As an example, the National Front for Ecologic Action created in 1987 was dedicated to educating public opinion on environmental issues and successfully pressured for the inclusion of a chapter on the environment in the 1988 Constitution (Alonso et al., 2005). Coordinating the actions of individual organizations were NGO networks that contributed to consolidating the environmental movement by enabling the exchange of experiences, thus forming the basis for large campaigns and serving as a vehicle for obtaining grants (Chadwick, 2000).

Protected Areas

At the United Nations Conference on the Environment in Stockholm in 1972, Brazil committed to creating its first environmental secretariat, the Secretariat for the Environment (SEMA, Decree 73.030, October 30, 1973), to develop policies for environmental protection and management (Drummond & Barros-Platiau, 2006). Its main achievements include the establishment of 38 ecological stations and 11 environmental protection areas between 1977 and 1986 (Aquino, 1979; Drummond, 1988; Nogueira, 1980, 2001; all cited in Drummond & Barros-Platiau, 2006, p. 92). With SEMA's addition of 3.2 million ha of ecological stations, protected areas reached 13 million ha by 1986 (Urban, 1998). The IBDF created a protected areas system parallel to that of SEMA's; between 1979 and 1986, the IBDF created 8.5 million ha of National Parks and National Biological Preserves, constituting some of the largest and most important of Brazil's conservation areas today (Drummond & Barros-Platiau, 2006).

The Ministry of Mines and Energy's RADAM project was undertaken between 1975 and 1983 to map the geology, geomorphology, hydrology, soils, and vegetation of the Brazilian Amazon. The project recommended the creation of 35.2 million ha of protected areas and another 71.5 million ha of sustainable-use areas. These areas were considered appropriate for conservation and sustainable use as no other use, such as settlement or mining, was identified (Rylands & Brandon, 2005). Of 25 priority conservation areas identified, 5 national parks and 4 reserves were created (Figueiredo, 2007; Mittermeier, da Fonseca, Rylands, & Brandon, 2005).

Although Brazil has allocated a large area of land to protected areas (11% of continental Brazil), the majority of the country's 60 national parks are considered paper parks (Figueiredo, 2007). Paper parks are areas declared by the government to be protected in law; they are characterized, however, by a lack of management capacity,

financing, infrastructure, contradictory legislation, and little integration of local communities in their management. In some instances, the creation of protected areas may be a cost-effective way of demonstrating a commitment to the environment without applying the resources required to effectively fulfill the commitment. As an indication, funding for the protected areas system in Brazil is low; between 1993 and 2000, federal spending for protected areas accounted for 0.3% to 0.5% of the Ministry of the Environment's budget, most of which was allocated to administrative and financial expenditures (Young & Roncisvalle, 2002, cited in Young, 2005, p. 757). Nonetheless, Brazil's protected areas and indigenous reserves, although underfunded, have had a quantifiable effect on serving as a barrier to deforestation and encroachment (Nepstad et al., 2006).

Constitutions, International Agreements, and the 1990s

Early treatment of forest resources in Brazil's constitutions focused on the jurisdiction between state and federal governments. The 1891 Constitution granted states autonomy over forest resources and property rights were unlimited. The 1934 Constitution (art. 5, XIX, j) transferred responsibility for forest law back to the federal government, although states could develop supplemental or complimentary legislation. In the 1967/1969 Constitutions, the management of forests was granted exclusively to the federal government (Viana, 2004). The current 1988 Constitution charges federal and state governments with developing and implementing legislation pertaining to the environment. Though municipal authority to legislate on forests is not explicitly stated, municipalities may legislate on issues of local interest, thereby supplementing federal legislation (art. 30, I and II; Viana, 2004, p. 10). Chapter VI of the Constitution, "On the Environment" proclaims that an ecologically balanced environment is a civil right and confers the protection of this right to the state and the public, for present and future generations. A number of biomes, including the Brazilian Amazon, were declared national patrimony and may only be used in such a way that the environment and natural resources are preserved and ecological functions are maintained.

The late 1980s and 1990s were particularly active years for forest policy in Brazil, both through domestic and international engagement. Due to SEMA and the IBDF's often overlapping mandates, these institutions along with the Secretary of Fishery Development (SUDEPE) and the Superintendence for Rubber (Sudhevea) were eliminated and replaced in 1989 by The Brazilian Institute of the Environment and Natural Resources (IBAMA) within the Ministry of the Interior, whose mandate was to formulate, coordinate, and implement national environmental and conservation policy and monitor and enforce compliance. The Secretariat for the Environment of the Presidency (SEMAM/PR) was created in 1990 and provided direct support to the presidential office (Ministerio do Meio Ambiente [MMA], 2008). In 1992 SEMAM/PR's responsibilities were transferred to the Ministry of the Environment (MMA)

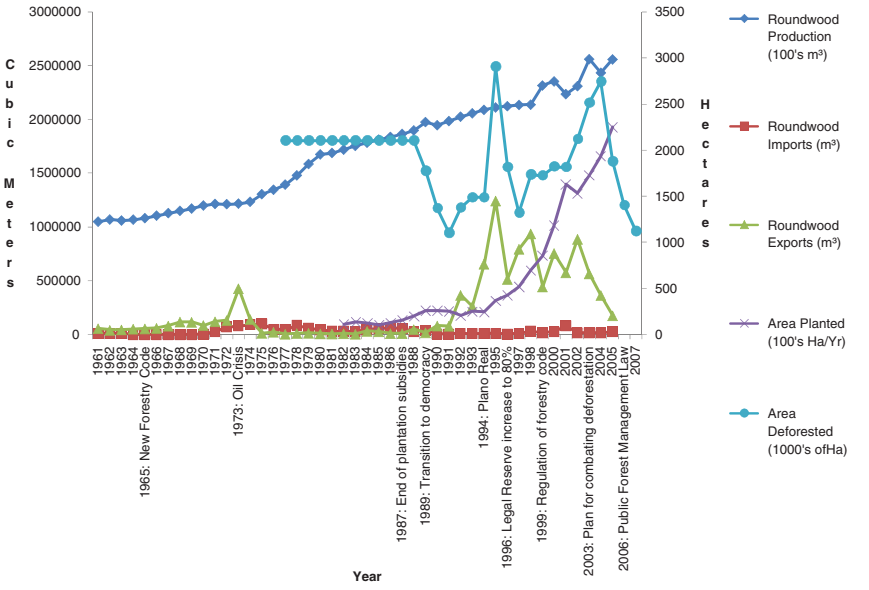
and is to date Brazil's top-level environmental institution charged with the management of the National Environment System (SISNAMA; Figueiredo, 2007, p. 65). This time period also saw a dramatic increase in international interest in the Amazon region as its importance for biodiversity and carbon sequestration became more evident, as did threats to its existence. The United Nations Environment and Development Conference held in Rio de Janeiro in 1992 resulted in Agenda 21, which dealt explicitly with forest resources. In 1998, the Environmental Crimes Law (Law No. 9.605, Lei de Crimes Ambientais) was approved to systematize the sanctions outlined in numerous legislative instruments and to address the recommendations of Agenda 21 (Viana, 2004). In Chapter V of this law, "On Crimes against the Environment", the penalties for violations of the new forestry code are described. An innovation introduced in the law is that companies would be subject to prosecution for environmental crimes whereas prior to this law, only citizens were liable (Drummond & Barros-Platiau, 2006).

Political Economy Impacts on the Forest Sector

Figure 1 reveals potential correlations between policy, forest sector production, and general economic conditions during the protectionist phase of forest policy development. First, roundwood production shows a steady increase over the period. Following the oil crisis in 1973, production grows at an unprecedented rate for the remainder of the decade. Growth in forest plantations follows an exponential trend, little affected by the elimination of plantation subsidies in 1987. Exports appear to follow deforestation levels closely, which may be related to the fact that most timber harvested in the Amazon was exported until the mid-1970s due to the lack of infrastructure connecting the region to what would later become the large markets for timber in southern Brazil (Lima et al., 2006). Peaks and troughs in exports appear to be correlated with the institution of the *Plano Real*, changes in Legal Reserve requirements and the development of regulations for the new forestry code.[4] Estimates on deforestation also follow these general trends.

Until 2005, deforestation levels increased rather steadily. Laurance, Albernaz, and da Costa (2002) show that although deforestation rates (absolute and per capita) declined slightly in the first few years of the 1990s compared with the period 1978 to 1989, they returned to historically high levels between 1995 and 2005. Variations in deforestation rates between years appear to be correlated with macroeconomic factors. For example, the relatively lower levels of deforestation between 1991 and 1994 are likely associated with the freezing of bank accounts that occurred the previous year, thus constraining investment and economic activity (Laurance et al., 2002). The drastic increase in 1995 is hypothesized to be a response to the increase in investment funds available due to stabilization measures contained in the *Plano Real* (Fearnside, 1999, cited in Laurance et al., 2002, p. 12). To help contain the deforestation that

Figure 1
Roundwood Production and Trade, Area Planted for Pulp and Paper, and Area Deforested



Source: Roundwood production, imports and exports (FAOSTAT, 2007); area planted (Brazilian Pulp and Paper Association [BRACELPA], 2005); area deforested (INPE, 2007).

followed the *Plano Real* and to improve Brazil's credibility in environmental policy within the international community, a provisional measure (Provisional Measure 1.511, August 22, 1996) was passed, increasing the Legal Reserve requirements to 80% in the Amazon biome (Hirakuri, 2003; Toni, 2006). The increasing trend in deforestation beginning in 2000 is thought to be a response to greater economic growth (Bugge, 2001, cited in Laurance et al., 2002, p. 12). Reductions in deforestation following 2004 may be related to the government's action plan to combat deforestation and the strengthening of the Brazilian *real* relative to the US dollar. Finally, Barreto, Pereira, and Arima (in preparation, cited in Barreto, Mesquita & Mercês, 2008, p. 13) find a close correlation between the area deforested between 1995 and 2007 and the cattle price index of the year prior to deforestation.

A number of recent events have the potential to influence forestland use significantly. First is the anticipated growth in Brazilian soybean production. Although it is argued that soybean expansion occurs mostly on areas previously cleared for pasture, recent research has shown that 23% of deforestation in 2003 was attributable to the direct conversion of forests to cropland (Morton et al., 2006). These findings suggest

that increased soybean production may present a greater threat to Amazon and cerrado ecosystems than once thought. Second is the consensus on the urgency of climate change mitigation and the role biofuels can play in reducing greenhouse gas emissions. Brazil is the second largest producer of ethanol. It is projected that the area planted with sugarcane to produce ethanol will increase by 121% by 2020 (Brazilian Sugarcane Industry Association [UNICA], 2008), which has raised concerns that sugar cane expansion will lead to more deforestation. As in the case of soybean cultivation, it is argued that sugarcane expansion will occur on degraded and underutilized pasture land. Research by Banerjee, Macpherson, and Alavalapati (forthcoming) indicates that greater demand for ethanol coupled with better production technologies will result in a relatively small (0.16%) increase in deforestation. Finally, the global economic downturn experienced in 2008 may result in the maintenance of more forest cover in the short-run. Assuming a link between commodity prices and rates of deforestation, reduced global demand and prices could have a forest-saving effect.

Sustainable Forest Management

As the influence of the environmental movement grew and civil society became more active in the political affairs of the country, forest policy began to transition to sustainable forest management with the turn of the millennium. Four critical developments between 1997 and 2006 can be identified that signal this transition: the institution of the National Forest Program (PNF), the National Conservation Area System (SNUC), the provision of fiscal incentives for natural forest management, and the PFML. These developments are discussed in turn.

In 1997, the federal government and the Food and Agriculture Organization (FAO) of the United Nations developed the Positive Agenda for the Forestry Sector to manage forests for socioeconomic development while maintaining environmental quality and ecosystem integrity. The Positive Agenda is one of Brazil's first policy references to forest-based sustainable development, differing significantly from the biocentric, protectionist view of previous years. The PNF and the Secretariat for Biodiversity and Forests were created as a result of this agenda.

The PNF is central to the political transition to balancing use and conservation, setting concrete and ambitious targets for the sustainable management of forest resources. It aims to increase Brazil's share of international timber markets from 4% to 10% by 2010, increase the area of sustainably managed forest on private land by 20 million ha, create 50 million ha of sustainable production forests on public land, and increase exports from natural forests from 5% to 30% by 2010 (Macqueen et al., 2003; Viana, 2004). Implementation of the PNF rests with the Coordinating Commission of the National Forests Program (CONAFLOR), which is composed of various government agencies and civil society. CONAFLOR develops policy in the areas of land tenure reform, credit and financing, environmental legislation, research, and training. Such a program for promoting sustainable forest management on public land is

unprecedented and marks the government's explicit recognition of the Brazilian Amazon as a region best suited for forest-based development (MMA, 2001). Affirming this declaration, the forestry sector was included as one of three priority program areas in the government's multiyear plan for the period between 2000 and 2003, the federal strategy for capital expenditures during a president's tenure.

The SNUC (Law 9.985, 2000) was approved in 2000 and details criteria and guidelines for the creation and management of conservation areas. The SNUC's mandate is to protect biodiversity while promoting sustainable development (Viana, 2004) and distinguishes sustainable use and strictly protected areas. Though protected areas have resource conservation as the main objective, sustainable use areas (which include national forests) seek to balance conservation with the sustainable harvest of natural resources. Demonstrating the new approach to natural forest resources, legislators use the term *management* instead of *protection* and consider communities an integral component of the landscape (Drummond & Barros-Platiau, 2006; Silva, 2005). Between 2002 and 2004 more than 3 million ha of protected areas were created, and currently approximately 11% of Brazil's area has been designated by federal or state governments as protected areas (Figueiredo, 2007).

Financial incentives for promoting natural forest management are new and coincide with the establishment of the PNF (Veríssimo, 2006). Funding is derived from Constitutional Funds for Regional Financing established by the 1988 Constitution, such as the Northern Financing Fund (FNO), the Central-West Financing Fund (FCO), and the Northeastern Financing Fund (FNE). Sourced from these funds, lines of credit with below market interest rates appropriate for the long maturation periods of forest investments were developed (Veríssimo, 2006). In 2003 the FNO was destined to receive a budget of 532 million *reais* with over 28 million *reais* allocated to its forestry development program (Banco da Amazônia, 2002). The PNF's creation of the forestry arm of the National Program for Strengthening Family Agriculture (PRONAF-Florestal) also provides resources to family farmers engaged in forest management and agroforestry. All these programs have disbursed a small fraction of the resources available, however. The FNO between 2003 and 2006 performed poorly mainly due to land tenure issues during the period, lack of industry access to public forestland, and difficulties in obtaining approval for forest management plans (Veríssimo, 2006). In the case of PRONAF-Florestal, lending is expected to increase in the future as program information is more effectively communicated and better technical support for the development and implementation of projects becomes available (Veríssimo, 2006).

Contemporary Forest Policy and the PFML

The creation of the PNF, SNUC, and incentives for natural forest management mark the transition from a protectionist to a sustainable management approach to

forest resources. With impetus from the PNF and the opportunity created by prevailing social and political economy considerations, a law promoting the management of public forests became source of intense debate. Although rudimentary provisions for such a law were first made in the Forestry Code of 1934, the PFML was passed in 2006 and details a comprehensive program for instituting forest management by private agents on public land. The implications of this law for promoting forest-based development in Brazil are significant; thus, the conditions that facilitated its approval merit in-depth analysis. In this section, the development of the law and its provisions are briefly described. The factors that interacted in such a way as to create a political window receptive to this policy are considered in detail.

The PFML

Until 2006, Brazil lacked a mechanism to regulate forest management on public land (Serviço Florestal Brasileiro [SFB], 2007). Since the 1934 Forestry Code, the first serious proposal to promote the sustainable management of public forests for timber and other forest goods and services was submitted by the government of Fernando Henrique Cardoso in 2002. This proposal was motivated by the need to control the illegal use of public forests, maintain its capacity to produce goods and services and foster socioeconomic development (SFB, 2007). With President Luiz Inácio Lula da Silva's government entering office in 2003, however, the proposal was withdrawn and the consultation process was reopened (Guevara, 2003). A working group involving all levels of government, researchers, and leaders in business, social mobilization, environmentalism, and politics met on various occasions over a period of 14 months to further develop the proposal. After numerous consultations and revisions, Brazil's first PFML (Law 11.284) was approved by Congress and sanctioned by President Lula in 2006.

The law regulates the management of public forests for sustainable use and conservation and creates the Brazilian Forest Service and the National Fund for Forest Development. Key principles of the law are the promotion of forest-based development, research, conservation, and the creation of the necessary conditions to stimulate long-term investment in forest management and conservation (art. 2). The law mandates the establishment of national, state, and municipal forests and forest concessions. In the case of forests occupied or used by local communities, extractive reserves and sustainable development reserves will be created.

Forest concessions, the law's principal mechanism for promoting the natural forest sector, are defined as the government's entrustment, through a competitive bidding process, to a legal private entity the right to practice sustainable forest management for the production of goods and services. Sustainable forest management is legally defined as management for the production of economic, social, and environmental benefits, while respecting ecosystem structure and function, which considers the management of various tree species, multiple nonwood products, and other forest goods and services (art. 3, VI).

A number of political, economic, and social variables interacted to create a political window receptive to the PFML. Some of these variables evolved over time such as the growing influence of the environmental movement, professional capacity in sustainable resources management, and an increasing trend in deforestation. The first 6 years of 2000 were also marked by events that created political opportunities for the development and eventual institution of the law. Record levels of deforestation in 2002 raised concerns about this seemingly untenable problem. Between 2003 and 2006, numerous covert enforcement operations uncovered the pervasiveness of illegal logging and exposed the entrenched interests of firms as well as public officials. The murder of an activist from the United States in 2005, fuelled by land disputes, drew domestic and international attention to the increasing violence in rural regions of the Brazilian Amazon. Crisis in the forestry sector in 2004 was brought about by government attention to questions of land tenure irregularities and the illegal use of public lands. Finally, the election of President Lula's Workers Party (PT) in 2002 and the appointment of environmental leaders to key posts contributed to a shifting tide of political will to address these issues. These variables are discussed in detail below.

Increasing Deforestation and Tackling Illegal Logging

Data released by the National Institute for Space Research (INPE) revealed that from August 2001 to 2002, there was a 40% increase in deforestation compared to the previous period (Fearnside & Barbosa, 2004). Occurring during a period of economic contraction, this was the second highest level of deforestation in history, second only to the deforestation that occurred in 1995. In light of acute domestic and international pressure, the government was forced into action. In 2003, it issued a presidential decree (July 3, 2003) creating the Permanent Inter-Ministerial Working Group for the Reduction of Deforestation in the Legal Amazon whose mandate was to develop measures and coordinate actions to reduce deforestation (Presidência da Republica, 2004). The main lines of action presented in their comprehensive Action Plan for the Prevention and Control of Deforestation in the Legal Amazon were land tenure reforms, improved environmental monitoring, enforcement, and support for sustainable forest-based development activities. Shortly after the plan was instituted, 19.5 million ha of federal conservation areas were established, and activities with potentially negative environmental impacts were prohibited along the BR-163 and BR-319 highways in the states of Pará and Amazonas, respectively.

Reductions in deforestation between 2004 and 2006 indicate that this plan may be contributing to improved monitoring and enforcement ("Governo cria UCs e distrito florestal no entorno da BR-163," 2006). Since 2004, for example, 19 field enforcement stations staffed with federal and military agents were located strategically within the so-called arc of deforestation. Stations monitor satellite data on deforestation and engage in operations targeting gangs involved in illegal logging and the illegal occupation of public land. Deforestation statistics released by INPE reveal that

deforestation has been significantly reduced in areas proximate to these field stations ("Governo cria UCs e distrito florestal no entorno da BR-163," 2006).

The timeliness of deforestation statistics has also improved markedly in recent years. Previously, reporting of deforestation indices was delayed by a number of years, often for political reasons (Fearnside & Barbosa, 2004). For example, the increase in deforestation in 1992 was not reported until 1995, whereas the historical peak of deforestation in 1995 was not reported until 1 month following the December 1997 Kyoto Conference on Global Warming. In 2002, the government announced that future estimates would be released as soon as they were available. Satellite technology, specifically the Real Time Deforestation Detection System (DETER) has allowed state agencies to monitor the Brazilian Amazon by satellite with a monthly coverage period. The greater ability to obtain information on deforestation in a timely manner and the increased transparency of the system is believed to be a contributing factor in reducing levels of deforestation by enabling more efficient allocation of resources for monitoring and enforcement.

Since the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon, the government and police have taken unprecedented action against illegal logging. Between October 2003 and 2006, 221 law enforcement operations were conducted, resulting in the seizure of 814,000 m^3 of wood; 800 million *reais* in fines issued; and 186 people incarcerated, 63 of whom were public servants. Of these operations, Operation Black September (state of Rondônia, 2003), Operation Farwest (state of Pará, 2004), and Operation Curupira I and II (states of Mato Grosso & Rondônia, 2005) were the largest. The perpetrators of the crimes were identified as a highly organized network of loggers, business people, and public officials. Operations Belém I and II also recovered substantial information regarding the trade in fraudulent Forest Product Transportation Authorization permits (ATPFs), which set the stage for the implementation of Operation Green Gold (Consulate General of Brazil in San Francisco, 2005). As a result of this operation, in October 2005, the federal police temporarily suspended all log transport from the Brazilian Amazon (Lima et al., 2006). One of the most recent enforcement operations, Operation Arc of Fire, began in February 2008, and by April of the same year $18.4 million in fines were issued, and more than 39,000 m^3 of illegally harvested timber were seized (Barrionuevo, 2008).

Although enforcement pressure and the value of fines issued for crimes against the environment have increased significantly, rates of collection remain low. IBAMA collected 14% of the value of fines owed between 1998 and 1999; between 2001 and 2004, the total value of fines issued by IBAMA increased by more than 181% from US$103 million to US$290 million, although only 2% of the fines issued for environmental crimes during this period were collected. Furthermore, goods seized through enforcement operations have largely not been disbursed; Barreto et al. (2008) reported that between 2004 and 2006, only 4% of the wood seized had been allocated to beneficiaries such as public or scientific institutions as is legislated in the

Environmental Crimes Law. Nonetheless, the illegal timber harvest reportedly fell from 47% to 43% of the overall harvest volume between 2001 and 2004 (Brito & Barreto, 2006).

Forestry Sector Crisis

Prior to 2003, forest management plans were approved based on precarious documentation from INCRA and state property registries. In fact, as long as a firm provided proof that it had initiated the land legalization process, it could submit a forest management plan for approval. Often by the time INCRA reached a decision regarding the legality of the claim, the property had been harvested and abandoned (Lima et al., 2006). In 2000, there were 3,000 management plans in the Brazilian Amazon. Following property registration and the inspection of existing forest management plans, close to 2,000 plans were canceled or suspended. In August of 2003, by the direction of IBAMA, forest management plans were no longer approved without proper documentation of land title. With forest industry access to private forestland brought to a near standstill, access to public forestland became critically important and consequently fueled debate on the proposal for the PFML.

In mid-2004, worker unions and forest sector associations petitioned the government to begin approving new forest management projects. Despite the fact that the government had decided not to authorize new plans on public land until the land tenure situation was resolved, it conceded to evaluating 49 areas of public forest for their potential management for timber. INCRA georeferenced 33 of these areas, and discussions took place on whether they would be made available for harvest. While management plans were being developed for these areas, a government decree requiring the registration of all rural properties was issued (Portaria Conjunta No. 10, December 2004). On December 28, 2004, the Ministry of Agricultural Development (MDA) in Pará announced that the 33 areas were not yet available and that firms would have to wait until the end of January 2005 for results of the evaluation. The Socio-Environmental Institute (ISA; "Governo Lula acaba se complicando no conflito de Novo Progresso," 2005) reported that the industry was under considerable strain and lacked sufficient volume of legally harvested timber to meet the demand of processing facilities. The situation reached crisis proportions with the suspension of 26 forest management plans in the region of Santarém.

On January 25, 2005, loggers responded to the crisis by initiating a blockade of the BR-163 Cuiabá–Santarém highway at Novo Progresso, paralyzing southwestern Pará for 11 days. On February 3, 2005, government officials, members of parliament and state representatives from Pará, along with leaders of timber and rural producer's organizations came to an agreement to end the blockade. The federal government conceded to reevaluate the suspension of forest management plans, authorize new plans in settlement areas, and send the proposal for a PFML to Congress ("Governo Lula acaba se complicando no conflito de Novo Progresso," 2005).

Escalating Violence

In the last 20 years, more than 500 people have been killed due to land conflicts in the state of Pará alone, from rural workers, farmers, and colonizers to leaders of agrarian reform and other social movements ("Quem chega primeiro na Amazônia," 2006). In the municipalities of Altamira and São Felix do Xingu in Pará, local residents reported armed bandits evicting 60 families, 90% of the population living along the margins of the Xingu and Iriri Rivers, from their land. In some cases, the bandits, sometimes accompanied by the state military police, looted and set fire to homes. The state argues that recent killings were a reaction to the land tenure regularization process ("Grileiros aterrorizam comunidades riberinhas na Terrra do Meio," 2005).

In February of 2005, the government responded to the murders of a series of rural workers and leaders of social movements, in particular the murder of Dorothy Stang, a U.S. missionary in Anapu, and the murder of Daniel Soares da Costa, a Rural Workers Union leader ("Brazil Farmers Bury Activist Nun," 2005). To curb further violence in the region and to identify and capture the killers, 110 soldiers were sent to Anapu and another 2,000 troops were deployed in Pará to maintain order ("Murder Prompts Brazil Amazon Curb," 2005).

In response to the violence and to gain control of public lands, the government launched a program to interdict land clearing for 6 months on 8.2 million ha in the area of the BR-163 highway until a land management plan was developed for the area. The plan was to include the creation of conservation areas, agrarian reform settlements, and a sustainable forestry district. In addition, 5.2 million ha of conservation areas were created, representing the single largest designation of conservation areas in Brazil's history ("Governo cria 5.2 milhões de hectares de áreas," 2005).

With the increased levels of violence, the forest sector in crisis and the political window that these and other factors provided, the proposal for a PFML was submitted to Congress as a constitutional emergency. One year following Dorothy Stang's murder, the federal government on February 13, 2006, created seven new conservation areas and increased the size of the National Park of Amazonia. These areas sum to 6.4 million ha of protected areas along the BR-163 ("Governo cria UCs e distrito florestal no entorno da BR-163," 2006) highway and form part of Brazil's first sustainable forestry district. This district is 16 million ha in size with 5 million ha allocated for forest management and represents the first state action founded in the new regulatory framework established by the PFML that was approved by Congress the week prior ("Governo cria UCs e distrito florestal no entorno da BR-163," 2006).

International Attention to the Amazon

International interest in the Amazon has increased in recent decades due to greater transparency, a globalized media, the timeliness of deforestation figures, and a growing recognition of the importance of the Amazon forest for biodiversity and carbon sequestration. In 1988, for example, deforestation figures were released

suggesting that the level of deforestation in 1987 was approximately 8 million ha. This figure, the intense media coverage of the fires burning in the Amazon and news of the assassination of rubber tapper Chico Mendes in 1988 drew attention to the region, raising concerns about global climate change and the rural workers' struggle to earn a livelihood from managing the forest (Kolk, 1996).

The World Commission on Environment and Development's 1987 report, "Our Common Future," further drew attention to the Amazon, identifying its importance as a genetic storehouse and generating interest in its potentially vast reserves of medicines and chemicals. The negative consequences of deforestation were also being felt in other countries and the sheer size of the Brazilian Amazon made it an easy target of international attention (Kolk, 1996). The growth and mobilization of environmental NGOs also assisted in focusing attention to the Amazon; NGOs in the United States campaigned heavily against the multilateral development banks, beginning in 1983, for their involvement in setting development agendas in developing countries. The bank-funded POLONOROESTE and Carajás projects were principal targets in Brazil where their environmental records were poor (Kolk, 1996). The Group of Seven's (G-7) concern for the environment was formalized in a 1989 summit where tropical forests were recognized for their important function in sequestering carbon. Out of the G-7's actions, the Pilot Program for the Brazilian Amazon was particularly significant, contributing to capacity development in policy, research, and management.

The PT

Finally, the election of the PT, led by Luis Inácio Lula da Silva in 2002, has contributed to creating a political environment that was more receptive to proposals for forest-based development. Becoming active in trade unions in 1978, President Lula was a founding member of the PT in 1980. On his fourth attempt at the presidency, he was elected in October 27, 2002, and affirmed the PT's commitment to assisting the poor and encouraging the participation of grassroots organizations ("Lula: Fourth Time Lucky," 2002). Lula is considered Brazil's first left-leaning president in the last 4 decades (Morton, 2005).

Four years following the assassination of Chico Mendes, Jorge Viana, member of the PT and a close associate of Chico Mendes, was elected governor of the Amazonian state of Acre. His goal was to be a "government for the forest" and its people (Rohter, 2002). Viana is in fact a forest engineer and considers that Acre's primary vocation is sustainable forest management. Marina Silva joined the PT in 1985 and was elected to the senate in 1994. Also a close friend of Mendes, Silva was appointed by Lula's government to the position of Minister of the Environment in January 2003 ("Brazil Environment Chief a Former Rubber Tapper," 2002). Although Silva proved to be instrumental in gaining support for sustainable development of the Amazon, she resigned in May 2008 after reportedly unsuccessfully

opposing a number of large infrastructure projects ("Brazil's Amazon Minister Resigns," 2008).

Summary and Conclusions

Table 1 summarizes key events and institutions in the evolution of Brazilian forest policy. As was the case with many countries in the Americas, the early period of settlement and exploitation was characterized by resource extraction to meet European demand for forest products. As the effect of largely unrestricted exploitation and settlement marked the landscape, particularly in Brazil's Atlantic forest region, policy makers recognized the need to regulate the use of forest resources and instituted the 1934 Forestry Code. As colonization and agricultural expansion remained the driving force of land use change, however, little progress was made in regulating forest use which pressed legislators to rework forest policy and develop the new forestry code of 1965.

During the protectionist period of forest policy development, policy implementation begins to bear some measurable change in forestland use. The new forestry code regulates forestry on private land. The SEMA was created in 1973 and along with the IBDF they established an extensive network of conservation areas. Although underfunded, these protected areas have been important in deterring illegal land use and occupation.

With the seeds of democracy sown in the mid-1970s and greater political space for environmental concerns, Brazil's National Environmental Policy was passed in 1981. The SEMA and the IBDF were replaced in 1989 by IBAMA to formulate, coordinate, and enforce national environmental policy, and the Ministry of the Environment, Brazil's top-level environmental institution, was created in 1992.

The Positive Agenda for the Forestry Sector was developed in 1997 that shortly afterwards would give rise to Brazil's PNF, setting ambitious goals for the management of both private and public forestland. The Environmental Crimes Law in 1998 established penalties for crimes against the environment. In the transition toward sustainable forest management, the SNUC detailed criteria and guidelines for the creation and management of conservation areas. An innovation in Constitutional Funds for Regional Financing created mechanisms for financing natural forest management in 2000 representing one of the first state-sponsored initiatives for the development of the natural forest management sector.

With the second highest level of deforestation reported during a period of economic contraction in 2001/2002, the state instituted the Permanent Inter-Ministerial Working Group for the Reduction of Deforestation in the Legal Amazon in 2003. Borne of this initiative was the Action Plan for the Prevention and Control of Deforestation that emphasized land tenure reform, improved environmental monitoring, and enforcement and support for forest-based development. Particularly significant of the management phase of forest policy development was the approval in 2006 of the PFML, which created the Brazilian Forest Service and developed a

Table 1
Trajectory of Brazilian Forest Policy

Settlement and Exploitation	Protectionism	Sustainable Forest Management	Year	Policy
X	—	—	1900s	Harvest of precious woods prohibited
X		—	1934	First forestry code and framework for forest concessions
—	X	—	1965	New forestry code and Legal Reserve requirement
—	X	—	1966	Forest plantation subsidies
—	X	—	1967	Brazilian Institute for Forestry Development
—	X	—	1973	Secretariat for the Environment
—	X	—	1981	National Environmental Policy
—	X	—	1989	Brazilian Institute of the Environment and Natural Resources
—	X	—	1992	Ministry of the Environment
—	X	—	1997	Federal government and Food and Agriculture Organization's Positive Agenda for the Forestry Sector
—	X	—	1998	Environmental Crimes Law
—	—	X	2000	National Forest Program
—	—	X	2000	National Conservation Area System
—	—	X	2000	Constitutional Funds for Regional Financing include forestry activities
—	—	X	2003	Permanent Inter-Ministerial Working Group for the Reduction of Deforestation Indices in the Legal Amazon
—	—	X	2004	Action Plan for the Prevention and Control of Deforestation in the Legal Amazon
—	—	X	2006	Public Forest Management Law; Brazilian Forestry Service

Source: Adapted from Marty's (1986) historical framework to summarize key events and institutions in the evolution of Brazilian forest policy.

framework for forest concessions on public forestland. With almost all legal forestry occurring on private land, forest concessions have the potential to dramatically transform the Brazilian forest industry.

The next few years will reveal whether the new policies and institutions established since 2000 represent a break from the low levels of implementation of the forest policies and programs of the protectionist phase of policy development. The experience with forest concessions, their ability to control the illegal use of public lands, achieve sustainable yields, and encourage management for multiple uses will provide indication of whether forest policy has in practice moved toward sustainable forest management.

With recent efforts to demarcate conservation areas, the state in partnership with civil society is making measurable progress in regulating public land use and occupation. Government neglect of the illegal exploitation of public lands is no longer an option from a political standpoint, with a globalized civil society and media ensuring that the illegal clearing of the countryside does not go unnoticed. Collusion between bureaucrats, politicians, and business has been exposed, and the risks involved in the illegal exploitation of forest resources are becoming greater.

The potential forests hold for creating socioeconomic stability and generating revenue and the role forest concessions and conservation areas may play in broadening support for political parties has rendered sustainable forest management an attractive alternative. As such, the state has recognized the Brazilian Amazon's primary vocation as forest-based development and committed more resources to gaining control over forest resources in the region. Though protectionist policies were outweighed by the colonization and resource-extractive agenda of the military regime, forest policy is becoming more aligned with extrasectoral policies. Subjecting subsidies for rural credit to environmental criteria, support for projects aimed at the recuperation of degraded areas and the allocation of forests for community use and development are indicative of this transition.

Brazil's transition to a paradigm of sustainable forest management is occurring at a time when the very concept of sustainable management is evolving rapidly. The environmental movement's focus on climate change and the environmental services that forests generate has increased the significance of forests in achieving a broader set of environmental sustainability goals. New instruments for the promotion of sustainable forest management, such as payments for environmental services, carbon credits for carbon sequestration, tradable deforestation permits, and compensation for avoided deforestation are some of the instruments under consideration. This rapidly changing environment presents challenges and potential synergies for the implementation of forest policy. Though the complexity of instruments has increased, we are beginning to see that this broadening definition of sustainable forest management is adding value to standing forests not only for the socioeconomic benefits they generate, but for the environmental services they provide.

Brazil's political economy is fundamentally different than it was during the protectionist period of forest policy development with democratization, a free and globalized media, an engaged civil society and a more stable macroeconomic environment. The political opportunity for the approval of the PFML set in the context of consistent economic growth and public engagement in the democratic process leads us to expect a significant shift in both policy and practice in how natural forest resources are managed and for whom.

Notes

1. This model has economic expansion as its primary objective with little consideration for the sustainable uses of resources. In Brazil, this model was characterized by pervasive state intervention in the

economy, state–corporatist mechanisms, and clientelism. To manage the ambitious developmentalist program, the state apparatus grew significantly, including state-run enterprises.

2. Since 1965, numerous provisional measures have been issued to modify the new forestry code, most of which dealt with aspects of the Legal Reserve and Permanent Preservation Areas. In force today, a Provisional Measure issued in 2001 (Medida Provisória No. 2.166-67, August 24, 2001) established Legal Reserve requirements of 80% and 35% for the high tropical forest and cerrado (a tropical grassland savannah considered the world's most biologically diverse grassland) biomes, respectively, and 20% for other regions (Viana, 2004).

3. The biocentric approach viewed environmentalism as the business of science and scientists, whereas the socioenvironmental approach viewed environmental issues from the perspective of the social sciences (Alonso et al., 2005).

4. The *Plano Real* was an economic stabilization plan developed by the government of President Fernando Henrique Cardoso.

References

Ahrens, S. (2003, August 25-28). O "novo" código florestal brasileiro: conceitos jurídicos fundamentais [The "new" Brazilian forestry code: Fundamental legal concepts]. Paper presented at the VIII Congresso Florestal Brasileiro, São Paulo, Brasil. Retrieved June 16, 2007, from http://www.ambientebrasil.com.br/florestal/download/SAhrensCodigoFlorestal.pdf

Alonso, A., Costa, V., & Maciel, D. (2005). *The formation of the Brazilian environmental movement* (Institute of Development Studies Working Paper 259). Retrieved December 9, 2007, from http://www.drc-citizenship.org/docs/publications/citizens_and_science/WP/Wp259.pdf

Aquino, T. (1979). Importância da Estação Ecológica no Sistema Nacional de Conservação do Meio Ambiente [Importance of ecological stations in the National Environmental System]. *Boletim FBCN, 14*, 81-84.

Banco da Amazônia. (2002). Fundo constitucional de financiamento do norte- plano de aplicação dos recursos 2003 a 2005 [Northern Constitutional Financing Fund- resource allocation plan for 2003 to 2005]. Gerência de Estudos Econômicos e Relações Institucionais. Retrieved January 21, 2002, from http://www.integracao.gov.br/fundos/fundos_constitucionais/index.asp?area=FNO%20-%20Programa%E7%E3o%202003

Banerjee, O., Macpherson, A., & Alavalapati, J. R. R. (forthcoming). *Socioeconomic and land use trade-offs of ethanol expansion in Brazil: A computable general equilibrium model*. *Journal of Sustainable Forestry*.

Barreto, P., Mesquita, M., & Mercês, H. (2008). A destinação de bens apreendidas em crimes ambientais na Amazônia [Allocation of goods seized due to environmental crimes in Amazônia]. Belém: Instituto do Homem e Meio Ambiente da Amazônia. Retrieved November 21, 2008, from http://www.imazon.org.br/publicacoes/publicacao.asp?id=563

Barreto, P., Pereira, R., & Arima, E. *O mercado de carne bovina e o futuro da pecuária na Amazônia Brasileira* [The beef market and the future of ranching in the Brazilian Amazon]. Belém: Imazon. Forthcoming 2009.

Barrionuevo, A. (2008, January). Agents armed with tape measures take on Brazil's renegade loggers. *International Herald Tribune*, Retrieved January 20, 2008, from http://www.iht.com/articles/2008/04/20/america/brazil.php

Brazil environment chief a former rubber tapper. (2002, December 11). *Environment News Service*. Retrieved July 4, 2007, from http://www.ens-newswire.com/ens/dec2002/2002-12-11-01.asp

Brazil farmers bury activist nun. (2005, February 16). *BBC News, Americas*. Retrieved June 16, 2007, from http://news.bbc.co.uk/2/hi/americas/4266959.stm

Brazilian Pulp and Paper Association. (2005). *Statistical forest report. GT reforestation and correlates.* Retrieved December 9, 2007, from http://www.ipef.br/estatisticas/relatorios/Bracelpa-Relatorio_Estatistico_Florestal-2005-Eng.pdf

Brazilian Sugarcane Industry Association. (2008). *Sugarcane industry in Brazil: Ethanol, Sugar, bioelectricity*. Sao Paulo, Brazil: Author.

Brazil's Amazon minister resigns. (2008, May 14). *BBC News, Americas.* Retrieved January 29, 2009, from http://news.bbc.co.uk/2/hi/americas/7399715.stm

Brito, B., & Barreto, P. (2006). *Enforcement against illegal logging in the Brazilian Amazon*. Retrieved April 1, 2008, from http://www.imazon.org.br/publicacoes/publicacao.asp?id=478

Chadwick, B. P. (2000). *Democratic environments: Democratization and the search for sustainable development in Brazil*. Unpublished doctoral dissertation, Columbia University, New York.

Consulate General of Brazil in San Francisco. (2005, June 2). *Brazilian government press release on the actions taken by the Ministry of Environment to dismantle gang acting in Mato Grosso for 14 years*. Retrieved June 16, 2007, from http://www.brazilsf.org/brazil_press6.htm

Drummond, J. (1988). *National Parks in Brazil: A study of 50 years of environmental policy (with case studies of the National Parks of Rio de Janeiro).* Unpublished master's thesis, Evergreen State College, Olympia, Washington.

Drummond, J., & Barros-Platiau, A. F. (2006). Brazilian environmental laws and policies, 1934-2002: A critical overview. *Law & Policy*, 28, 83-108.

FAOSTAT. (2005). *ForestSTAT. Online forest sector statistical database.* Retrieved December 9, 2007, from http://faostat.fao.org/site/381/default.aspx

Fearnside, P. M. (1980). The effects of cattle pasture on soil fertility in the Brazilian Amazon: Consequences for beef production sustainability. *Tropical Ecology, 21*(1), 125-137.

Fearnside, P. M. (1999). Biodiversity as an environmental service in Brazil's Amazonian forests: Risks, value and conservation. *Environmental Conservation, 26*, 305-321.

Fearnside, P. M., & Barbosa, R. I. (2004). Accelerating deforestation in Brazilian Amazonia: Towards answering open questions. *Environmental Conservation*, 31, 7-10.

Figueiredo, C. C. M. (2007). *From paper parks to real conservation: Case studies of national park management effectiveness in Brazil.* Unpublished doctoral dissertation, the Ohio State University, Columbus.

Governo cria 5.2 milhões de hectares de áreas protegidas e interdita outros 8,2 milhões para estudos [Government creates 5.2 million hectares of protected areas and freezes access to 8.2 million hectares for further study]. (2005, February 18). *Instituto Socioambiental, Noticias Socioambientais*. Retrieved June 16, 2007, from http://www.socioambiental.org/nsa/detalhe?id=1924

Governo cria UCs e distrito florestal no entorno da BR-163 (Cuiabá-Santarém) [Government creates conservation areas and forestry district around the BR-163 (Cuiabá-Santarém) highway]. (2006, February 14). *Instituto Socioambiental, Noticias Socioambientais*. Retrieved June 16, 2007, from http://www.socioambiental.org/nsa/detalhe?id=2189

Governo Lula acaba se complicando no conflito de Novo Progresso [Lula government becomes involved in the conflict in Novo Progresso]. (2005, February 15). *Instituto Socioambiental, Noticias Socioambientais*. Retrieved June 16, 2007, from http://www.socioambiental.org/nsa/detalhe?id=1920

Grileiros aterrorizam comunidades riberinhas na Terrra do Meio (PA) [Squatters terrorize riverine communities in Terra do Meio, Pará]. (2005, January 31). *Instituto Socioambiental, Noticias Socioambientais*. Retrieved June 16, 2007, from http://www.socioambiental.org/nsa/detalhe?id=1912

Guevara, R. (2003). Making concessions in Brazil. *International Tropical Timber Organization Tropical Forest Update*. Retrieved November 12, 2007, from http://219.127.136.74/live/Live_Server/311/tfu.2003.03(03).e.pdf

Hirakuri, S. R. (2003). *Can law save the forests? Lessons from Finland and Brazil*. Bogor, West Java, Indonesia: Center for International Forestry Research. Retrieved June 16, 2007, from http://www.cifor.cgiar.org/publications/pdf_files/Books/Law.pdf

Instituto Nacional de Pesquisas Espaciais [INPE]. (2007). *Projeto PRODES- monitoramento da floresta Amazônica Brasileira por satélite* [Project PRODES- monitoring the Brazilian Amazon forest by satellite]. Retrieved December 9, 2007, from http://www.obt.inpe.br/prodes/index.html

Kengen, S. (2001, July 4-7). A *política florestal Brasileira: uma perspectiva histórica* [Brazilian forest policy: A historical perspective]. Paper presented at 1º Simpósio Ibero-Americano de Gestão e Economia Florestal, Porto Seguro, Brazil. Instituto de Pesquisas e Estudos Florestais. (2001). Retrieved May 4, 2007, from http://www.ipef.br/eventos/siagef2001/programacao.html

Kolk, A. (1996). *Forests in international environmental politics: International organisations, NGOs and the Brazilian Amazon.* Utrecht, the Netherlands: International Books.

Laurance, W. F., Albernaz, A. K. M., & da Costa, C. (2002). O desmatamento está se acelerando na Amazônia Brasileira? [Is deforestation accelerating in the Brazilian Amazon?] *Biota Neotropica, 2*(1), 1-9. Retrieved June 16, 2007, from http://lcluc.umd.edu/products/LBA_page/files_fr_2_25_email/Laur2001_Is_Defor_Portg.pdf

Lima, E., Merry, F., Nepstad, D., Amacher, G., Azevedo-Ramos, C., Resque, F., et al. (2006). Searching for sustainability: Forest policies, smallholders and the Trans-Amazon Highway. *Environment, 48*, 26-37.

Lula: Fourth time lucky. (2002, October 28). *BBC News World Edition*. Retrieved July 4, 2007, from http://news.bbc.co.uk/2/hi/americas/2367851.stm

Macqueen, D., Grieg-Gran, M., Lima, E., MacGregor, J., Merry, F., Prochnick, V., et al. (2003). *Growing timber exports: The Brazilian tropical timber industry and international markets.* Edinburgh, UK: International Institute for Environment and Development. Retrieved October 14, 2007, from http://www.iied.org/pubs/display.php?n=2&l=2&a=R%20Smeraldi&x=Y

Mahar, D. J. (1989). *Government policies and deforestation in Brazil's Amazon Region*. Washington, DC: The World Bank.

Marty, R. J. (1986). The economics of forestry—forestry and economic development. In G. W. Sharpe, C. W. Hendee, & W. Sharpe (Eds.), *Introduction to forestry*. New York: McGraw-Hill.

Mery, G., Kengen, S., & Luján, C. (2001). Forest-based development in Brazil, Chile and Mexico. In M. Palo, J. Uusivuori, & G. Mery (Eds.), *World forests, markets and policies*. Dordecht, the Netherlands: Kluwer Academic.

Ministerio do Meio Ambiente. (2001). *The National Forest Program- PNF*. Brasilia: Ministerio do Meio Ambiente/ Serviço Florestal Brasileiro/Diretoria de Florestas. Retrieved June 29, 2007, from http://www.brasilemb.org/environment/pnfing.pdf

Ministerio do Meio Ambiente. (2008). Ministerio do Meio Ambiente histórico institucional [Institutional history of the Ministry of the Environment]. Retrieved January 29, 2009, from http://www.mma.gov.br/sitio/index.php?ido=conteudo.monta&idEstrutura= 88&idConteudo=8309#91

Mittermeier, R. A., da Fonseca, G. A. B., Rylands, A. B., & Brandon, K. (2005). A brief history of biodiversity conservation in Brazil. *Conservation Biology, 19*, 601-607.

Morton, D. (2005, September/October). Looking at Lula-Brazil's Amazon deforestation worsens despite a "Green" President. *EMagazine.com*, pp. 14-16. Retrieved October 14, 2007, from http://www.emagazine.com/view/?2839

Morton, D. C., DeFries, R. S., Shimabukuro, Y .E., Anderson, L. O., Arai, E., Espirito-Santo, F., et al. (2006). Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon. *Proceedings of the National Academy of Sciences of the United States, 103*, 14637-14641. Retrieved January 29, 2009, from http://www.pnas.org/content/103/39/14637.full.pdf+html?sid=0d0ca7a9-c57c-4e4e-9020-fd01f72fe2ca

Murder prompts Brazil Amazon curb. (2005, February 18). *BBC News, Americas*. Retrieved June 16, 2007, from http://news.bbc.co.uk/1/hi/world/americas/4275781.stm#

Nepstad, D., Schwartzman, S., Bamberger, B., Santilli, M., Ray, D., Schlesinger, P., et al. (2006). Inhibition of Amazon deforestation and fire by parks and indigenous lands. *Conservation Biology*, *20*(1), 65-73.

Nogueira, N. P. (1980). Um novo conceito de Estação Ecológica [A new concept for ecological stations]. *Boletim FBCN, 15*, 37-39.

Nogueira, N. P. (2001). Evolução histórica das ARIEs e APAs [Historical evolution of ARIEs and APAs]. In A. H. Benjamin (Ed.), *Direito ambiental das Áreas Protegidas*. São Paulo: Forense Universitária.

Ondro, W. J., Couto, L., & Betters, D. R. (1995). The status and practice of forestry in Brazil in the early 1990s. *The Forestry Chronicle, 71*(1), 106-119.

Presidência da Republica. (2004). *Plano de ação para prevenção e controle do desmatamento na Amazônia Legal* [Action plan for the prevention and control of deforestation in the Legal Amazon]. Brasília: Grupo Permanente de Trabalho Interministerial para a Redução dos Índices de Desmatamento da Amazônia Legal. Retrieved June 16, 2007, from http://www.planalto.gov.br/casacivil/desmat.pdf

Quem chega primeiro na Amazônia: o estado ou o grileiro? [Who arrives first in the Amazon: The state or the squatter?] (2006, November). *Instituto Socioambiental [ISA]*. Retrieved June 16, 2007, from http://www.socioambiental.org/esp/desmatamento/site/grilagem

Rohter, L. (2002, September 23). A Brazilian campaign that is all about the jungle. *The New York Times*. Retrieved October 14, 2007, from http://query.nytimes.com/gst/fullpage.html?res=9506E7D91739F930A1575AC0A9649C8B63&n=Top/News/Science/Topics/Environment

Rylands, A. B., & Brandon, K. (2005). Brazilian protected areas. *Conservation Biology, 19*, 612-618.

Serviço Florestal Brasileiro [SFB]. (2007). *Gestão das florestas públicas- relatório 2006* [Management of public forests- review of 2006]. Brasília: Ministério do Meio Ambiente. Retrieved June 16, 2007, from http://www.amazonia.org.br/arquivos/240311.pdf

Silva, M. (2005). The Brazilian protected areas program. *Conservation Biology, 19*, 608-611.

Siqueira, C. F. A., & Nogueira, J. M. (2004). *O Novo Código Florestal e a reserva legal: do preservacionismo desumano ao conservacionismo politicamente correto* [The new forestry code and the legal reserve: From biocentric preservation to politically correction conservation]. Anais do XLII Encontro Brasileiro de Economia e Sociologia Rural- Encontro da SOBER, Cuiabá, 2004. Retrieved June 16, 2007, from http://www.unb.br/face/eco/jmn/trabalhos/2004/novocodigoflorestal.pdf

Toni, F. (2006). *Gestão florestal na Amazônia Brasileira- avanços e obstáculos em um sistema federalista* [Forest management in the Brazilian Amazon- advances and obstacles in a federal system]. La Paz: Plural Editores. Retrieved June 16, 2007, from http://www.cifor.cgiar.org/publications/pdf_files/Books/BToni0601P.pdf

Urban, T. (1998). *Saudade do matão: relembrando a história da conservação da natureza no Brasil* [Longing for the forest: Remembering the history of conservation in Brazil]. Curitiba, Parana, Brazil: Editora da UFPR.

Veríssimo, A. (2006). *Estratégia e mecanismos financeiros para florestas nativas do Brasil* [Strategies and mechanisms for financing native forests of Brazil]. Food and Agriculture Organization. Retrieved June 16, 2007, from http://www.docpark.net/FAO-Fo/Esp/NATIVA_BRASIL_fev06_Final_1.pdf

Viana, M. B. (2004). *A contribuição parlamentar para a política florestal no Brasil.* Brasília: Câmara dos Deputados. Retrieved June 16, 2007, from http://www2.camara.gov.br/internet/publicacoes/estnottec/tema14/pdf/2004_10446.pdf

Young, C. E. F., & Roncisvalle, C. A. (2002). *Expenditures, investment and financing for sustainable development in Brazil* [The parliamentary contribution to forest policy in Brazil]. U.N. Comisión Económica para América Latina, Santiago.

Young, E. F. (2005). Financial mechanisms for conservation in Brazil. *Conservation Biology, 19*, 756-761.

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