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Governmental Forest Policy for Sustainable Forest Management in Costa Rica, Guatemala, and Nicaragua: Regulation, Implementation, and Impact

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We evaluated how governmental forest regulation in Costa Rica, Guatemala, and Nicaragua has succeeded or failed in fostering changes in forest owner and user behavior that enhance the sustainability of tropical forest management. As expected, sufficient resources and capacity for forest policy implementation are crucial for attaining governmental forest policy objectives, but innovative arrangements for promoting, enforcing, and verifying policy compliance can compensate for limited regulatory resources and processes. The findings also indicate that: the level of governmental commitment to sustainable forest management (SFM) was as important as total funding levels; a mix of government rules and incentives enhanced adoption of SFM; the incorporation of professional forest regents offset limited agency capacity; and forest certification enhanced SFM on forest concessions.

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Local level inducements and constraints that enhance or impede governmental forest policy adoption and compliance also were identified.

KEYWORDS Costa Rica, forest policy, forest regulation, Guatemala, Nicaragua, sustainable forest management, tropical forests

INTRODUCTION

Governmental forest regulation is typically established to prevent resource exhaustion and protect long-term values not provided well by markets (Cubbage, Harou, & Sills, 2007, p. 840). In the tropics, though, it is often criticized for failing to curtail continuing rates of deforestation and forest degradation. Regulatory failures in the tropics are often linked to poor enforcement, corruption, and weak legal systems (see, for example: Contreras-Hermosilla, 2002; Hickey, 2004; Cashore & McDermott, 2004; Meidinger, 2003; Rametsteiner & Simula, 2003). Yet, not enough is known about the regulatory policies themselves, their implementation, and their intended and unintended impacts (Agrawal, Chhatre, & Hardin, 2008; Cubbage et al., 2007; Cashore & McDermott, 2004). These factors are all crucial for understanding policy effectiveness and fundamental to better decisions and applications of relevant policy tools and mixes aimed at increasing forest sustainability in the tropics. Therefore, we carried out a cross-country comparative analysis of governmental forest regulation in Costa Rica, Guatemala, and Nicaragua to determine the policy outputs and implementation measures and means that lead the intended, as well as unintended changes in forest owner and user behavior and their decisions to related to sustainably tropical forest management.

Governmental regulation of forest use typically sets a minimum standard and/or defines permissible and prohibited forest practices (Moffat & Cubbage, 2001). It can include voluntary or mandatory technologies, performance standards, and/or best management practices (BMPs). These regulations all may include guidelines for harvest plans, road construction, extraction, reforestation, and management of sensitive areas such as endangered species habitat, riparian zones, and steep slopes (Toffelson, 1998; Moffat & Cubbage, 2001; Louman, Quiros, & Nilsson, 2001). The complexity (e.g., species composition, vertical structure) and values (e.g., aesthetic, cultural, spiritual, option) associated with forest ecosystems often influence the regulation of forest management (Glück, 2005).

Cashore and McDermott (2004) examined the ecological and operational content of forestry regulations from 20 developed and developing countries. The authors compared forest regulatory stringency (i.e., “extent to

which policies include substantive requirements prescribing specific forest practices," p. 395) through key measures common to forest regulations and important to the concepts of sustainable forest management (SFM), including the management of riparian zones, clear-cuts, road construction, reforestation, and annual allowable cut. They found a wide range of variation among the countries, with forest regulations in developing countries on average demonstrating more prescriptive regulations and higher performance thresholds than those in developed countries. Their findings further reveal that the developing country case studies exhibited contradictory land-use policies, such as incentives for agricultural and grazing land development in areas zoned for forest land use, underfunded government institutions, and a lack of enforcement capacity.

Research on governmental forest regulation in the tropics has also focused specifically on illegal logging and its impacts on tropical forests and society (see, for example: Contreras-Hermosilla, 2002; Ravenel, Granoff, & Magee, 2004; FAO/ITTO, 2005; Tacconi, 2007). Drivers of illegal logging are typically linked to flawed or weak legal frameworks; insufficient enforcement and monitoring; and corruption in the public and private sectors (FAO/ITTO, 2005; Contreras-Hermosilla, 2002). The identification of illegal logging drivers and strategies for improving forest law compliance are important to policy makers and other tropical forest stakeholders. Yet, a broader focus that includes an examination of regulatory forest policy and compliance is likely to reveal other governmental and non-governmental policy tools that promote SFM, as well as important incentives for, or intervening factors in, regulatory forest policy adoption and compliance.

RESEARCH METHODS

We designed this research to better understand how and why governmental forest regulation leads to, or fails to produce, the desired changes in forest owner and user behavior. In addition to the preceding literature, we drew on "smart regulation" theory (Gunningham & Grabosky, 1998) to examine the effectiveness of governmental regulation in fostering SFM in the tropics, and how regulation of SFM is enhanced or impeded by intervening factors at the national and local levels. We implemented a mixed methods theory-based approach to policy analysis through comparative country-level case studies in Costa Rica, Guatemala, and Nicaragua (for a detailed description of methods see McGinley, 2008). These countries encompass tropical forests that provide important resources and services at local, national, regional, and global levels. Moreover, they represent a range in local contexts, forest policy instruments, forest management and deforestation issues, and forest management outcomes necessary for examining our research questions.

We conducted in-country fieldwork and data collection from March to July 2007. Data collection focused on governmental forest policies, the means and processes in place for their implementation, their adoption and compliance by forest owners and users, and intervening factors in forest policy implementation and its impacts at the national and local levels. Primary data collection encompassed the gathering of relevant governmental and non-governmental forest policy directives and instruments, as well as semi-structured interviews with key forest policy actors. We interviewed a total of 88 individuals from forest agencies; forest owners and managers; and local and regional forestry experts in Costa Rica, Guatemala, and Nicaragua. These interviews were conducted to gather information on experiences with and perspectives on governmental forest policy, its implementation, and impacts. Published research, governmental and non-governmental reports and documentation, and other secondary data were also collected and analyzed, and then triangulated with the primary data through converging lines of inquiry.

RESULTS

The forest policy contexts in Costa Rica, Guatemala, and Nicaragua affect the development and implementation of governmental forest regulation and promotion of SFM. In particular, national level environmental, socioeconomic, and sociopolitical factors influence the development of forest management directives, as well as the means and processes for putting policy directives into practice. These factors combine to impact forest owners and users' decisions regarding forest policy adoption and compliance, which are also affected by intervening factors at the local or forest management unit level.

Forest Policy Contexts

Overall, the national-level forest policy context in each country represents opportunities and challenges for the development, implementation, and ultimate outcomes of regulatory forest policy. In Costa Rica, forests were subject to significant conversion to agricultural and grazing lands throughout much of the 20th century, such that, by 1983, only 26% of the original forested territory remained (MINAE, 2001). Increasing wealth and development over the past two decades have led to decreasing pressures on the forest for conversion, subsistence, and settlement, causing the abandonment of agricultural and grazing lands. This transition has resulted in the recent recuperation and subsequent increases in forest area. In 2005, the per capita gross domestic product (GDP) was $4,627 (UNDP, 2006), and forest cover was 46.8% (2.39 million ha) of the country (FAO, 2007). Nonetheless, pressures on

forests for continuing expansion of the agricultural frontier and suburban development persist in Costa Rica (Campos, Villalobos, & Louman, 2005).

In Guatemala, poverty and population dynamics have produced significant pressures on forests, as reflected in a high rate of forest loss relative to the region. The 2005 per capita GDP was US$ 2,517 and the population growth rate between 2000 and 2005 was 2.5%, the highest in the Americas (DDG/WB, 2007). Meanwhile, forest cover in 2005 was 36.3% (3.94 million ha) and the annual rate of change in forest area from 2000 to 2005 was −1.3% per year, the fourth highest rate of deforestation in Americas (FAO, 2007). While much of Guatemala's forests have been fragmented or converted to other land uses, significant expanses of natural forest can still be found within the National Protected Areas System. The Maya Biosphere Reserve (MBR) is the largest protected area in the country, extending over 2.11 million ha and encompassing nearly 1.7 million ha of forest (CEMEC, 2004).

The MBR is divided into three zones. The nucleus zone (767,000 ha, 36%) encompasses national parks, biotopes, and other biological corridors where human intervention is prohibited. Multiple use zones (848,440 ha, 40%) function as a first-order buffer to the nucleus zones. Specified activities and sustainable harvest of wood and non-wood products are permitted in this zone with authorization and oversight by the *Consejo Nacional de Áreas Protegidas* (CONAP—National Council for Protected Areas). A buffer zone (497,500 ha; 24%) along the southern border of the reserve, where land stabilization and resource use is promoted through approved practices, serves as a second-order buffer to the nucleus zone (USAID/CONAP/FIPA, 2001; Manzanero, Gomez, Breitling, & de Camino, 2006).

Nicaragua has the greatest amount of forest area (5.19 million ha; 42.7% forest cover) of the three countries (FAO, 2007). However, Nicaragua is considered one of the poorest countries in the hemisphere with a per capita GDP of US$895 in 2005 (DDG/WB, 2007; UNDP, 2006). Poverty-related pressures on the forest—including fuelwood collection, shifting agriculture, conversion of forest for agricultural and grazing land—are extensive. These pressures have contributed to one of the highest rates of forest loss in the region. Equal to the rate of deforestation in Guatemala, the average annual change in forest area in Nicaragua between 2000 and 2005 was −1.3% (FAO, 2007).

Governmental Forest Policy Directives

Policy directives are the formal written outputs that governments use to provide specific measures for implementing principles and goals (Anderson, 1984; Birkland, 2005). In the case of forestry, they are typically laws, regulations, rules, norms, and standards of good forest practice. We analyzed forest laws; regulations; and related directives in terms of the operational,

ecological, economic, and social forest management issues addressed and the associated thresholds intended to limit forest management impacts.

Forest laws, regulations, and related directives restricted timber production to private land in Costa Rica (GoCR, 1996, 1997, 1998, 2002)[1] and Nicaragua (GoN, 2003a, 2003b, 2004); while in Guatemala, laws, regulations, and related directives were in place for timber production within and outside protected areas (GoG, 1996, 1997; INAB, 2003; GoG, 1989, 1990; CONAP, 1999). Though the Guatemalan Protected Areas Law (GoG, 1989) permitted the harvest of timber resources for family consumption in all protected areas, commercial forest production was only permitted in the multiple-use zone of the MBR through long-term (25 yr) forest concessions. As of 2007, there were 12 community forest concessions and 2 industrial forest concessions encompassing over 500,000 ha in the MBR (CONAP, 2007).

In all cases, governmental regulatory policy directives for timber production from natural forests focused significantly on the ecological and operational aspects of forest management (Table 1). For example, in all cases, policy directives prescribed extensive planning requirements (e.g., forest inventory; general forest management and annual operating plans); riparian buffer zones; and diameter limits on harvestable tree species. Other ecological and operational aspects of natural forest management—such as road construction, slope and harvest limits, and species protections—also were addressed to varying degrees across the three countries.

The social and economic aspects of forest management addressed by governmental forest policy directives differed across countries (Table 1), but in all cases, were addressed to a lesser degree than the operational and ecological aspects of forest management. Community consultation and conflict resolution and the recognition of indigenous rights and interests were addressed to varying degrees in all cases, except for managed forests outside

TABLE 1 Key SFM Aspects Addressed Through Governmental Forest Policy Prescriptions in Costa Rica, Guatemala, and Nicaragua in 2007

	Costa Rica	Guatemala PA*	Guatemala OPA*	Nicaragua
Operational				
Planning	√	√	√	√
Slope limits	√	√		√
Ecological				
Riparian buffers	√	√	√	√
Tree size limits	√	√	√	√
Social				
Worker safety	√	√		
Indigenous rights	√	√		√
Economic				
Financial analyses		√		

Note. *PA = within protected areas; OPA = outside protected areas.

protected areas in Guatemala. Worker safety was regulated in Costa Rica and in protected areas in Guatemala. Financial analyses of timber production were mandated in managed forests within protected areas of Guatemala, though in no other case. Costa Rican directives indicated that the "costs and benefits" of natural forest management should be considered within the planning process, but financial analyses were not required. Overall, the regulations for natural forest management in Costa Rica and in protected areas of Guatemala were the most comprehensive and rigorous in terms of the operational, ecological, social, and economic forestry aspects and the associated thresholds on management impacts.

In Costa Rica and Nicaragua, additional governmental directives were in place by 2007 that ultimately impacted the effectiveness of forest regulation. Conversion of forest to other land uses was prohibited on public and private land in Costa Rica (GoCR, 1996). Timber harvest from "farmland without forest," defined as areas on private lands with forests less than 2 ha in size, or areas with trees that are remnants from previously cleared forests, was also regulated but with far fewer requirements than natural forest management (GoCR, 1997). Ultimately, in Costa Rica, forest owners and managers clandestinely converted natural forest to "farmland with trees" by cutting the forest understory, establishing pasture grass beneath the remaining canopy trees, and then requesting a permit for the harvest of "trees on farmland." Through the misuse of this type of permit, they avoided the rigorous regulations for natural forest management, in order to illegally convert natural forest to "farmland" (GoCR, 2004).

In Nicaragua, in addition to the governmental forest directives for natural forests described above, there were scaled-down requirements for authorized timber harvest in "fragmented forests," defined as natural forests less than 50 ha (GoN, 2003a, 2003b). Interviews of INAFOR personnel and studies conducted by Global Witness (2007) and the Center for Communication Research and the Center for International Policy (CINCO & CIP, 2006) all indicated that these permits were often misused by forest owners, loggers, or forest regents to request authorization for timber harvests in forest areas larger than 50 ha, leading to the fragmentation and degradation of once continuous forests. The abuses and other transgressions in the timber production sector ultimately led to a Presidential Declaration of a State of Economic Emergency in May 2006 (GoN, 2006a) that included the temporary suspension of all harvest, transportation, processing, and export of timber in the principal timber producing departments (i.e., Nueva Segovia, Rio San Juan, and the Northern and Southern Atlantic Autonomous Regions).

Then, in June of 2006, the Nicaraguan National Assembly passed the Law Banning Logging, which wholly banned the extraction and commercialization of six timber species throughout the country and banned all timber extraction from within 10 km of the national borders and within 15 km around protected areas, for a period of 10 yr (GoN, 2006b). The

Law listed the banned trees as "*caoba*, *cedro*, *pochote*, *pino*, *mangle*, and *ceibo*." Scientific names were not included, leaving significant ambiguity as to which species were banned. For example, *cedro* is a common name for royal cedar (*Cedrela odorata*), which has been over-harvested for decades, as well as *cedro macho* (*Carapa guianensis*) and other cedar species important for timber production and prevalent throughout the broadleaf forests of Nicaragua. These and other ambiguities and inconsistencies with existing forest law complicated the implementation of SFM policy in Nicaragua, as discussed in more detail in the sections below.

Regulatory Forest Policy Instruments

The primary forest policy tool for regulating and promoting SFM in each country was a command-and-control approach that included the regulation of timber production as well as penalties and fines for noncompliance. Guatemala and Nicaragua implemented taxes on timber production from natural forest management, while timber production was not taxed in Costa Rica at the time of this study. The requirement in Guatemala's MBR for third-party forest certification of community and industrial forest concessions was unique among the countries. The certification of forest concessions was mandated through the governmental forest policy directives for protected areas (CONAP, 1999). Though on a limited scale, the three countries also employed informational policy instruments such as technical assistance and educational/awareness campaigns related to SFM and aimed at forest owners and users.

Governments used fiscal incentives to promote regulatory forest policy adoption and compliance to varying degrees. In Guatemala, there was an extensive forest incentives program to promote natural forest management, forest protection, and reforestation outside of protected areas. As of 2006, over 60,000 ha of managed natural forest had been enrolled in the national forest incentives program (de la Roca, 2007). Though the state provided no fiscal incentives for forest management in protected areas, forest owners and managers viewed access to long-term usufruct rights to the forest resources through the concession system as a considerable incentive for the adoption of SFM in the MBR. In addition, since its creation, the MBR had received considerable external investment and support from donor agencies and international non-governmental organizations. From 1996 to 2005, these organizations invested US$325 million into sustainable forest management in the MBR, in addition to over US$1 billion invested into community development in the reserve (Gomez & Mendez, 2005).

In Nicaragua, the Forest Law created a program of fiscal incentives for forest protection, management, and planting (GoN, 2003a). However, as of 2007, there had been no disbursement of incentives for natural forest management in Nicaragua. In Costa Rica, a national program for the

Payment of Environmental Services from forests was initially created with payments directed to natural forest management (GoCR, 1996). However, as of 2005, payments were no longer extended to managed forests (FONAFIFO, 2008), nor were there any other fiscal incentives in place for natural forest management in Costa Rica in 2007.

Means for Implementing Regulatory Forest Policies

In addition to examining governmental forest policy directives and instruments for regulating and promoting SFM in Costa Rica, Guatemala, and Nicaragua, we examined the means and processes in place for regulatory forest policy implementation. "Means" encompassed organizational structures (e.g., agency centralization and autonomy) and financial, human, and material resources.

In all cases, the organizational structures in place for implementing governmental forest policy directives encompassed a regulatory agency that was decentralized logistically, with a central office in the capitol and regional and/or district offices throughout the territory. There was no or very limited decentralization of financial resources for forest policy implementation in the three countries and the decentralization of decision making varied across cases.

The Guatemalan *Instituto Nacional de Bosques* (INAB—National Institute for Forests), which oversees forest management outside of protected areas, demonstrated the most decentralized decision-making processes, largely facilitated through the autonomy of its organizational structure. INAB was established as an "autonomous and independent" agency, led by a multi-stakeholder board of directors, which was intended to reduce the agency's susceptibility to political influence and to enhance program and personnel stability (GoG, 1996). Conversely, most of the decision-making power in Guatemala's protected areas administration was centralized. CONAP was established with dual leadership under the President and a multi-stakeholder council (GoG, 1989), which, as indicated by a range of interviewees (i.e., forest experts, managers, and agency personnel), limited its autonomy and increased its susceptibility to external political interests. Nonetheless, the Region VIII Forest Division of CONAP, which oversees the forest concessions in the MBR, demonstrated considerable autonomy in terms of the decision making and even policy making related to the regulation of natural resources harvests in the Reserve. This local autonomy permitted a discernible and significant degree of adaptiveness of regulatory policy to forest management impacts and experiences in the MBR.

All governmental forest agencies were limited by insufficient financial resources (as noted in over 90% of all interviews)—particularly CONAP and INAFOR, which were responsible for vast areas of forestland with comparatively minimal financial resources. Insufficient and/or ineffective material

resources—such as modes of transportation and technological tools—were also considered significant limitations on effective forest policy implementation (noted in over 75% of all interviews). Also, while interview respondents generally viewed regulatory forest agencies limited in terms of the number of personnel, 68% of them in Costa Rica and Guatemala described regulatory forest agents as skilled and competent in these two countries. However, corruption within the forest agencies was noted in all cases, particularly in Nicaragua (noted in 20% of interviews; and documented in CINCO & CIP, 2006).

Processes for Regulatory Forest Policy Implementation

The processes for implementing regulatory forest policy in each of the case studies included the procedures for authorizing, verifying, and enforcing compliance with governmental regulatory forest policy. Specifically, we investigated timber harvest authorization, timber harvest oversight, and verification and enforcement of regulatory compliance.

The three countries prescribed in-office and site inspections of proposed timber harvests from natural forests as a prerequisite for timber harvest authorization (Table 2). In all cases, pre-harvest site inspections were fairly consistently applied, even in the context of limited financial, human, and material resources.

In Guatemala, authorization procedures for timber harvests in natural forests were standardized within and outside of protected areas by CONAP and INAB, respectively. Additionally, unique among the cases, CONAP's procedures for timber harvest authorization in protected areas were adaptive to regulatory and management experiences and impacts (Carrera, Stoian, Campos, Morales, & Pinelo, 2006; Manzanero et al., 2006). In Nicaragua, timber harvest authorization by INAFOR required approval from additional actors (i.e., the local Mayor's Office, and the Regional Council's Office in the case of the Autonomous Regions; GoN, 2003b), making it the most inclusive of forest stakeholders and local government. Nonetheless, the roles and

TABLE 2 Key Processes Carried Out by Forest Regulatory Agencies in the Regulation of Natural Forest Timber Production in Costa Rica, Guatemala, and Nicaragua in 2007

	Costa Rica	Guatemala PA*	Guatemala OPA*	Nicaragua
Harvest authorization				
Pre-harvest in-office plan review	√	√	√	√
Pre-harvest site inspection	√	√	√	√
Verification of compliance				
Operations site inspection		√	√	
Post-harvest site inspection		√	√	√

Note. *PA = within protected areas; OPA = outside protected areas.

responsibilities of these cosignatory parties were not well-defined and led to delays and conflicts in the overall regulatory process.

Once authorized, forest regulatory agencies approached the oversight of forest operations differently (Table 2). In Guatemala, the regulatory processes of INAB and CONAP included site inspections of ongoing operations to determine their compliance with regulatory forest policy and the authorized harvest plan (GoG, 1997; CONAP, 1999). Conversely, in Costa Rica and Nicaragua, oversight of authorized forest operations was delegated to *regentes forestales* (forest regents; GoCR, 1997, 2002; GoN, 2003b). A forest regent is a professional forester, registered with the state, and given public trust to oversee and ensure the legal compliance of timber operations in the field. A system of forest regents was in place in all countries and the state required their oversight of forest operations in all cases (GoCR, 1996, 1997; GoG, 1996; CONAP, 1999; GoN, 2003a, 2003b). Yet, whereas forest regents were solely responsible for operational oversight in Costa Rica and Nicaragua, forest regulatory agencies in Guatemala exercised oversight of authorized forest operations as well.

In Costa Rica, additional processes were developed and implemented for authorizing and verifying the harvest of trees from farmland. Initially, a request for permits to harvest timber from these areas did not require a field inspection by the regulatory agency (GoCR, 1997). Once the misuse of these permits in the conversion of forest to farmland became apparent, the *Administración Forestal Estatal* (AFE—State Forest Administration) modified the permitting process for harvesting trees from farmland, requiring petitioners to include GPS coordinates of the area from which trees would be harvested. As part of the new authorization process, the GPS coordinates had to be verified in the field by AFE personnel and cross-checked against the 2000 Costa Rican Forest Cover map (GoCR, 2004). A range of interviewees—including forest managers, experts, and agency personnel—all note that these modifications had led to reductions in the misuse of permits for trees from farmland, but had also significantly increased the workload of an already limited regulatory agency.

Another key component in forest regulatory enforcement is the oversight of timber transportation. In each of the countries, all transported wood required official documentation and permits. In the case of wood from natural forests, the regulatory agency issued transportation permits based on the timber volume authorized in the management or operating plan (GoCR, 1996, 1997; GoG, 1996; CONAP, 1999; GoN, 2003a, 2003b). In each country, the forest regent was delegated with responsibility for overseeing correct usage of these permits. All cases enlisted the National Police to verify the legality of transported timber in coordination with the forest regulatory agency at designated checkpoints throughout the country. In Nicaragua, the National Army was also given responsibilities for manning timber checkpoints. Nevertheless, more than half of all interviews identified

the legal verification of transported timber as one of the weakest points in the regulatory system. Respondents principally attributed this weakness to a shortage of checkpoints, insufficient training of checkpoint operators in terms of species and volume identification, and a failure to link information from timber transportation permits and their review at checkpoints to authorized forest management plans and timber volumes.

Finally, the judicial system affected enforcement of forest regulatory compliance, particularly through the prosecution and punishment of forest-related crimes, defined in legal directives in all cases. In Nicaragua, the Attorney General for the Environment and the Environmental Prosecutors Office identified and aggressively prosecuted transgressions in authorized timber harvests from natural forests, yet few of these had been punished in a court of law (CINCO & CIP, 2006; INAFOR, 2007). In Costa Rica and Guatemala, the prosecution of forest crimes was nominal. In all cases, lack of penalization of forest crimes through the judicial system resulted in limited deterrence for illicit forest acts and noncompliance with governmental forest regulation.

Forest Policy Adoption and Compliance by Forest Owners and Users

Forest landowner policy adoption and compliance eventually determines policy effectiveness. We focused on the aspects of regulatory forest policy and its implementation, as well as the aspects of the local or forest management unit context, that affect forest owners and users in their decisions on forest use. These characteristics influence the ultimate adoption (or rejection) of and compliance (or noncompliance) with regulatory forest policy. Such aspects included forest ownership, size, and distribution; forest management capacity; and external support for local-level forest management.

In Costa Rica, where governmental regulatory forest policy for natural forest management was applied on-the-ground, evidence suggests that compliance with governmental directives was very high (SINAC, 2008; Louman et al., 2005). Nonetheless, the adoption of regulated natural forest management declined significantly between the mid-1990s and the mid-2000s (Arce & Barrantes, 2006).[2] It should be noted that during this time frame, while the submission of natural forests to legal forest management decreased, a large area of natural forest—nearly 532,000 ha from 1997 to 2007—was enrolled in the Environmental Services Payments Program (FONAFIFO, 2008). However, a significant amount of timber from "farmlands" was also approved by the AFE during this time frame, much of which was suspected to have been clandestinely converted from natural forest (Arce & Barrantes, 2006).[3] In cases of clandestine forest conversion, governmental regulatory forest policy was essentially rejected by forest owners and managers since forest land use change was prohibited by law (GoCR, 1996).

Supporters of regulatory forest policy adoption and compliance in Costa Rica included an active group of forestry NGOs that promoted SFM and provided technical assistance to forest owners and users (e.g., FUNDECOR; CODEFORSA). However, additional inducements for policy adoption and compliance were limited. Constraints to governmental forest regulation were largely linked to forest size and distribution in Costa Rica. Forests available for timber production were typically small (< 100 ha on average, and commonly < 50 ha), fragmented, and part of a mixed land-use system in which agriculture and pasture are the dominant land uses and often the primary source of income for the forest owner (Campos et al., 2005). As noted in a broad range of interviews and documented by Navarro and Bermúdez (2006), small, fragmented forests and rigorous standards for natural forest management in Costa Rica combined to produce high costs associated with regulatory forest policy adoption and compliance, which ultimately deterred many forest owners and users from implementing natural forest management on their land.

In Guatemala, between 1999 and 2005, a total of over 200,000 ha of natural forest outside protected areas were legally managed for timber production under authorized forest management plans (INAB, 2005, 2006). Though compliance of natural forest management outside protected areas with governmental regulations was not systematically monitored, incentive payments for natural forest management required proof of regulatory compliance (GoG, 1996, 1997). Between 1999 and 2005, a total of more than 58,000 ha of managed natural forests were enrolled in PINFOR (Oliva & Paiz, 2005), indicating that at least 30% of the total forest area under authorized forest management plans between 1999–2005 was verified by INAB as compliant with forest regulations.

Inducements to the adoption of regulatory forest policy outside protected areas in Guatemala were largely associated with a well-funded and sufficiently implemented national program of forest incentives. There were nearly 60,000 ha of managed natural forest enrolled in the incentives program as of 2006 and interest and enrollment in the program had steadily increased since its inception (Oliva & Paiz, 2005). Forest owners and experts also cited INAB's positive public image and strong regulatory oversight as inducements to policy adoption and compliance. Policy constraints were largely related to the small size (45 ha on average) and fragmentation of much of the forestland outside protected areas. Several INAB personnel and forest managers and experts noted that these small, fragmented forests represented similar challenges for policy adoption and compliance to those in Costa Rica, particularly in the costs of legal forest management on small forests (even with comparatively less rigorous regulations).

In the protected areas system of Guatemala, the adoption of and compliance with governmental forest regulatory policy was the most extensive of the three countries. In 2007, nearly 0.5 million ha of forest were under

regulated natural forest management through the forest concessions system of the MBR (CONAP, 2007). Moreover, 95% of the forest area covered by the forest concessions was independently certified by SmartWood as soundly managed and in compliance with governmental regulations and certification standards as of November 2007 (FSC, 2008). Nonetheless, the land tenure system in this context was considerably different from the other cases; the state owned the land, leased the long-term usufruct forest rights to communities or industrial operations, and mandated comparatively more rigorous requirements for forest use, such as third-party forest certification (CONAP, 1999).

The factors that promoted and constrained governmental forest management policy adoption and compliance in Guatemala's protected areas were quite different than those associated with forests outside protected areas and on private land in the other cases studied. For example, the forest concession system in the MBR had benefited from extensive outside financial and technical support since the early 1990s. During the first decade or so of the forest concessions, international donors subsidized most of the costs of forest management (and certification) in the community concessions, while also funding large-scale technical assistance and presence (Gomez & Mendez, 2005). This financial and technical support contributed significantly to increased regulatory forest policy adoption and compliance in the community concessions, as noted by concessionaires, forest agency representatives, and forest experts.

Over time, the community concessionaires had gained considerable experience in sustainable forestry and, as of 2007, carried out and funded most of the related activities themselves. An additional inducement to regulatory compliance was the requirement for third-party certification of forest concessions. The majority (78%) of interviewed community and industrial concessionaires and forest managers agreed that forest certification had promoted compliance with governmental forest regulations and overall advance toward SFM. Nonetheless, regulatory policy compliance in the forest concessions was not uniform. Smaller concessions often produced smaller profits which increased difficulty in effectively complying with rigorous and costly governmental forest policy directives (Manzanero et al., 2006).

In Nicaragua, where there was the largest area of forest available for timber production, regulatory forest policy adoption and compliance was erratic and had been in decline since the mid-2000s (INAFOR, 2007).[4] As we discussed above, this decline was caused partly by ambiguous governmental restrictions on timber production from natural forests, namely the Law Banning Logging. All forest owners and users also noted that the decline was additionally due to their frustrations with increasingly complicated access to legal forest management. Even where natural forest management was authorized in Nicaragua, two major studies demonstrated that noncompliance with governmental forest policy directives and serious regulatory infractions were

common (CINCO & CIP, 2006; Global Witness, 2007). Lack of compliance with governmental forest regulations was found to occur throughout much of Nicaragua, "regardless of ownership, size, and actors involved" (Global Witness, 2007, p. 9).

There were very limited inducements to forest policy adoption and compliance in Nicaragua in 2007, which did include a few key NGOs with forestry programs that promoted SFM and provided technical forestry assistance (e.g., Rainforest Alliance; WWF/Masagni). The constraints to regulatory forest policy adoption and compliance in Nicaragua were linked largely to limited agency resources that resulted in poor oversight of timber production and transgressions in natural forest management. Such lapses eventually led to increased restrictions on forest productivity from natural forests through increasingly restrictive legislation on timber production and a ban on key timber species and areas of timber production (GoN, 2006a, 2006b). Additional constraints against increased policy adoption and compliance in Nicaragua differed regionally. In the eastern part of the country, forests are typically fragmented and small (< 50 ha), resulting in high costs associated with forest regulatory compliance, similar to legal forest production costs in Costa Rica and outside protected areas in Guatemala (Del Gatto, *et al.*, 2006). In the West, unclear and insecure land tenure among indigenous and community lands, which dominated the landscape, posed a significant challenge to SFM adoption and compliance (CINCO & CIP, 2006; Del Gatto, Faurby, Navarro, & Argüello, 2006).

CONCLUSIONS AND POLICY IMPLICATIONS

Many factors at several levels combined to influence the effectiveness of governmental policy for promoting and enhancing sustainable forest management in Costa Rica, Guatemala, and Nicaragua. Rigorous and comprehensive regulatory forest management directives were intended to decrease the negative operational, ecological, economic, and social impacts and outcomes of tropical forest management and increase overall forest sustainability. However, insufficient or inadequate organizational structures, means, and processes for policy implementation diminished the potentially positive outcomes of regulatory rigor and comprehensiveness. Limited organizational structures and resources for implementing regulatory forest policy represented a critical impediment to enhanced forest policy adoption and compliance, regardless of the rigor or comprehensiveness of governmental forest management directives.

Gaps and failures in the timber tracking and judicial systems also adversely affected the effective implementation of governmental forest policy. Where there was limited or nonexistent penalization of forest-related crimes through the judicial system, there was reduced deterrence for

noncompliance with forest law and illicit forest activity. Such failures also were embodied in relatively lax forest use policy options, for example harvest permits for fragmented forests less than 50 ha in Nicaragua or for remnant trees on farmland in Costa Rica, which landowners misused to avoid more rigorous regulations for natural forest management. Ultimately, such flaws or loopholes limit the potentially positive on-the-ground outcomes of governmental policy for sustainable forest management.

Several factors contributed to more effective regulatory forest policy implementation and enhanced adoption and compliance. First, forest agency autonomy and decentralization of resources and decision-making processes often enhanced regulatory forest management policy implementation. Additionally, limited resources for policy implementation were frequently positively mitigated, to some degree, by innovative forest policy enforcement and/or verification arrangements, such as the incorporation of private or non-governmental actors in the oversight of forest management compliance (e.g., forest regents, independent certifiers). However, the effectiveness of these non-traditional regulatory enforcement and oversight arrangements in enhancing regulatory forest policy adoption and compliance largely depended on clearly defined roles, responsibilities, and integration with regulatory forest structures and processes.

Governmental educational and technical assistance programs related to forest regulation and sustainability often positively affect regulatory forest policy adoption and compliance. Adoption and compliance also were often bolstered by complementary policy instruments such as fiscal incentives for natural forest management, as in the case of forests outside protected areas in Guatemala. Integrated participation, financial support, and technical assistance from non-governmental forest policy actors also demonstrated positive effects for enhancing regulatory forest policy and SFM, particularly in the forest concessions of the MBR. Overall, the integration of these types of policy tools and actors fits well within the concepts of "smart regulation" as proposed by Gunningham and Grabosky (1998), supporting their premise that the use of multiple policy instruments, and a greater range of regulatory actors, results in better environmental regulation.

We also identified the intervening effects of the forest management unit or local level contexts on regulatory forest policy adoption and compliance. Widespread adoption of and compliance with forest regulation was mitigated in large part by the associated costs. Such costs tended to rise on smaller forest management units and with increasingly rigorous, comprehensive, and complicated regulatory forest directives and processes, deterring policy uptake. In particular, rigorous regulatory policy for natural forest management in Costa Rica led to the pursuit of loopholes related to the definition of "forest." Nonetheless, some limitations to policy adoption and compliance at the local level, such as forest size and costs of compliance, were positively mitigated through financial and technical support. Examples of such support

included the Forest Incentives Program for forests outside protected areas in Guatemala; the extensive and long-term assistance from bilateral, multilateral, and private donors active in the MBR; and, on a smaller scale, active forestry organizations in all three countries.

In conclusion, this study identifies key factors in the development and implementation of governmental policies for promoting SFM in the tropics. Most importantly, a rigorous regulatory approach to controlling forest use requires substantial resources in order to be effective. Smart approaches to forest regulations that integrate complementary policy instruments and actors can work to increase forest policy uptake by forest owners and users, particularly where resources for policy implementation are limited. Broad restrictions on forest use, including logging bans and prohibitively rigorous regulations, can have unintended consequences, such as increased illicit forest activity or the conversion of forests, especially when enforcement is weak due to limited resources. Furthermore, a balance between restrictions on forest use and rules for other land use activities is necessary to avoid creating contradictory incentives to convert and/or degrade forests through circumvention of stringent forest policy. Finally, effective regulatory forest policy for achieving SFM must include comprehensive and rigorous policy directives that can be implemented with existing agency resources. The policy must be enhanced by inducements, such as fiscal incentives and long-term usufruct forest rights; must incorporate external actors who can help facilitate the regulatory process; and must be flexible enough to provide forest owners and users various means to achieve the goals of sustainable forest management in the tropics.

NOTES

1. In June 2008, Costa Rica published new standards for natural forest management that included Principles, Criteria, and Indicators of SFM; a Code of Forest Practices; and a Procedures Manual. While beyond the scope of this study, it should be noted these new standards were developed in response to implementation challenges associated with the previous standards and are considered comparatively clearer and more concise regulations for natural forest management (J. Rodriguez Quiros, personal communication, May 14, 2007).

2. In Costa Rica, roundwood production from natural forests was 475,000 m^3 in 1996; 248,000 m^3 in 1998; 53,000 m^3 in 2000; 50,000 m^3 in 2004; and 35,000 m^3 in 2006 [0](Arce & Barrantes, 2006).

3. In Costa Rica, roundwood production from farmlands was 458,000 m^3 in 1998; 467,000 m^3 in 2000; 359,000 m^3 in 2002; and 259,000 m^3 in 2004 (Arce & Barrantes, 2006).

4. In Nicaragua, authorized timber products from managed natural forests were 211,000 m^3 in 2005; 113,000 m^3 in 2006; and 31,000 m^3 in 2007 (INAFOR, 2007).

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