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Compliance with sustainable forest management guidelines in three timber concessions in the Venezuelan Guayana: Analysis and implications

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ABSTRACT

After more than 40 years of natural forest management (NFM) in Venezuela, out of 16 million ha of production forests only 10% located in the Guayana region is currently being managed with some consideration of sustainability. A recent survey of three private concessions in the Imataca Forest Reserve, based on partial consideration of criteria and indicators for the sustainable management of tropical forests, revealed that a new form of management is needed. Compliance with reduced impact logging was very low, with poor planning in logging operations detected in all cases, highly affecting forest stands and biomass recovery. A limited capacity for monitoring was also found. Social assessments showed that local communities in all cases demanded more participation in wood production benefits and tended to value provision services such as timber, food and water above other important regulations and cultural services. Here, three strategies are proposed as an effective way to partially modify NFM into a more integrated approach: 1) strengthening of institutional cooperation between private and public sectors and capacity building in the process of monitoring; 2) creation of a training framework for reduced impact logging techniques 3) a review of current legal structures and national policies related to NFM in order to favour small-scale operations.

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1. Introduction

Since 1980, the area of tropical forests used for wood production purposes has consistently increased. In recent years it has risen from about 42 M ha to close to 353 M ha (FAO, 2001; ITTO, 2006). This increase has represented a significant contribution to national and local economies. However the implementation of sustainable forest management procedures for timber is still very limited. Complex challenges are being faced in many tropical countries where natural forest management (NFM) still represents a sound option. These critical issues include land tenure and social participation in forest benefits management, reduction of the ecological impact of logging activities, biodiversity conservation, small-scale vs. large-scale operations (Karsenty et al., 2008) and more recently the role of tropical forest ecosystems in climate change mitigation (Lewis, 2006). In addition, how to capture the total value from tropical forests through multiple-use options is presently a matter of concern (Guariguata et al., 2009).

Forest concessions have been an important part of forestry in many tropical countries. Management operations have been implemented through large-scale industrial models involving a mutual contract based on the agreement of a forest owner (in most cases represented by the figure of the national government) and another

party permitting the use of a given area for harvesting of timber or other forest resources (Gray, 2002). In South American countries, for example, industrial forest concessions have been operating for over two decades (for instance Bolivia started in 1996 and Peru in 2001) using a concession-based regime for managing and selectively logging their natural forests. More often than not, the concession experience in these countries has not been successful (Gray, 2002). Logical arguments against this model remain when poor logging practices are still the rule in most cases of wood extraction in the tropics (see for example Putz et al., 2000, for a more detailed analysis). Opponents to the use of tropical forests for timber production argue that misguided forestry can play a critical role in the overexploitation of forest resources, promoting other critical forces of degradation such as illegal logging, wild-life hunting, land-use changes, which may aggravate rather than slow down the problem of biodiversity loss (Nielsen and Rice, 2006).

Venezuela is a tropical country with one of the longest history of forest management under the forest concession model (see Dourojeanni, 2000; Kammesheidt et al., 2001; Torres-Lezama et al., 2008). During the 1970s, the introduction of a forest concession system represented a significant advance in NFM at a regional level. The first private concessions were awarded in 1970. By 1992 almost 3.2 million ha had been allocated in more than 30 forest management units (FMUs) or concessions (Centeno, 1995); the highest proportion was in the Imataca Forest Reserve (Guayana region). In 1995, the national government planned to increase the area under forestry concessions to 10 million ha over 5 years,

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but the country's adoption of structural adjustment policies and the rising criticism of forest management strategies prevented this from happening (Torres-Lezama et al., 2008).

A significant reduction in timber production coming from FMUs occurred when in 1987 almost 40% of the national round wood production came from this form of management (Centeno, 1995), and 20 years later this proportion dropped to 7% (MinAmb, 2008). A critical analysis of the forest management model applied in Venezuela is explained in detail in Centeno (1995), Aicher (2005) and Lozada (2007). Those reports remarked on critical limitations in the implementation of adequate measures to assure the long term permanence of production forests and a total absence of sustainable management guidelines during the monitoring activities. After more than four decades of NFM in Venezuela, of the 16 million ha of production forests, a very low proportion of close to 3% of permanent production forests (PFF) are considered as being sustainably managed (ITTO, 2006). In addition, a lack of updated management plans and adequate monitoring are also part of the current situation of forest management in the country. The few community-based efforts to incorporate local people into benefits management resulted in catastrophic ecological effects (cf. Lozada, 2007; Rojas-López, 2007), and there are currently no certified natural forests in Venezuela. As occurs in many tropical production forests, most of the timber coming from natural forests in Venezuela is harvested to meet the demands of the domestic market where environmental concerns have less weight. As a consequence, many wood companies are reluctant to implement better logging practices and to improve other critical areas of forest management.

In the last 20 years several initiatives, mainly through the efforts of international organisations such as the International Tropical Timber Organization (ITTO, 2005), have been developed for the purpose of ensuring that the sustainable management of tropical forests can be achieved. One important initiative is the instrument of Criteria and Indicators (C&I) to measure and monitor the sustainability of forests (Mendoza and Prabhu, 2000). In general, it is useful to think of C&I as information nodes on several areas of concern, which together provide a full picture of the state of the forests and current sustainability trends (Pokorny and Adams, 2003). An example of how C&I work in forest concessions is explained in Mendoza and Prabhu (2000), and Pokorny et al. (2005). Further information about the concession model and its effectiveness can be found in Gray (2002) and Karsenty et al. (2008).

Improving the performance of forest concessions is not likely to be a popular topic. Nevertheless, if sustainable management is to be achieved in Venezuelan tropical forests, it may be necessary to assess and analyse the results of more than 40 years of concession management. So far, considering that Venezuela is one of the countries in the tropics that have been largely neglected in the subject of NFM literature, there is an urgent need for information on how critical issues of management are being implemented nowadays. Therefore, in this paper we present an analysis after applying the first known attempt to evaluate a selected group of C&I for assessing specific aspects of sustainable forest management for timber. Based on a survey of three industrial forest concessions located in the Venezuelan Guayana, we include a discussion on the compliance of current practices with sustainable management guidelines, followed by a debate considering the perspectives of the concession model in national forest management.

2. Methods

2.1. The study site

The Imataca Forest Reserve (IFR) is located within the Guayana shield covering part of the Bolívar and Delta Amacuro states in NW Venezuela. It was created on January 6th 1961 with a regulatory framework establishing, as principal purpose, forest management for timber. It has an estimated area of 3.8 M ha (Berroterán, 2003).

Two other designated production forests (San Pedro and Dorado-Tumeremo), and Canaima National Park are located on the southern boundary of this reserve (Ochoa, 1997).

On a regional scale, the majority of IFR falls into Holdridge's Moist Tropical Forest Life Zone (Ewel et al., 1968). Rainfall distribution is highly variable. The northeastern and southwestern parts reach precipitation values above 2100 mm per year. Rainfall in the northwestern and central areas of IFR are between 1500 and 2000 mm year⁻¹. Mean precipitation is 1630 mm, with higher values occurring between May and July (Berroterán, 2003). The mean annual temperature is close to 25 °C and air relative humidity varies from 75 to 87% (Ochoa, 1998). Close to 65% of the reserve is covered by dense lowland forests (<500 m of altitude) (Berroterán, 2003) shaping a forest continuum with French Guiana and Surinam to the east and the Amazon basin to the south, as one of the last frontier forests in South America (Bryant et al., 1997; Lozada et al., 2007). The most common tree species are *Pentaclethra macroloba* (Willd.) Kuntze; *Alexa imperatricis* (R.H. Schomb.) Baill.; *Eschweilera subglandulosa* (Steud. ex O. Berg) Miers; *E. decolorans* Sandwith; *Protium neglectum* Swart; *Licania densiflora* Kleinhoonte and *Carapa guianensis* Aubl. (Berroterán, 2003; Lozada et al., 2007). Twelve management units with extensions ranging between 120,000 and 340,000 ha are distributed in IFR, but only six are actively implementing their forest management plans. An updated status and detailed situation of each concession is shown in Table 1 and in Figs. 1 and 2.

The population in IFR was close to 5000 inhabitants in 1982, reached almost 18,000 by 1992, and had an estimated 30,000 people in 2005 (Berroterán, 2003). Indigenous/native groups represent approximately 45% of the local population located mainly in the central and southern parts (GFW-VEN, 2002). Fallow agriculture through slash and burn practices is probably the most common subsistence activity for most of the population. In recent years, the incorporation of indigenous groups into gold mining activities has become a major threat to the traditional structure of the local population and to the fragile ecosystems in the Reserve (Berroterán, 2003).

2.2. Research approach

From 2006 to 2009 we performed a survey on three different concessions in the IFR: one located in the northern part (CODEFORSA) and two near the centre (COMAFOR/Hermanos Hernández) (Fig. 2). The main criteria used for selecting forest concessions included the existence and implementation of a management plan, officially approved according to national forest legislation, uninterrupted activities in forest concessions for a minimum of 3 years and a guarantee of field support during the assessments. Table 2 shows a comparison of several management parameters of the selected concessions in IFR.

The general approach used in this study consisted, firstly of a detailed characterisation of the selected concessions through data collection, for examining biophysical and socio-economic conditions. In this regard, all selected sites share many similarities especially in terms of ecological processes on a regional scale. Threats to the natural system are also common for the three concessions; although a consistent pressure on gold mining (formal and informal) is more evident in the central part of the Imataca Forest Reserve. The general profile of local communities is different between sites. COMAFOR and Hermanos Hernández concessions are located within an area inhabited by indigenous communities, mainly from the group 'Kariña'.

Secondly, a partial assessment of C&I for sustainable forest management was performed. The main goal was orientated to a survey on the degree of compliance of management plans and to assess key issues, especially those regarding logging operations. Considering that this is the first report on C&I generated for NFM in Venezuela, in this work it was considered convenient to perform an initial adaptation procedure of the C&I tool by selecting 2 criteria, 5 indicators and 13 verifiers involving information about forest resources security and the continuity of timber production (Table 3). In this matter, we

Table 1

Current status (2011) of timber concessions in the Imataca Forest Reserve (grey cells highlight cases used in this research).

Management Unit ¹	Name	Type	Date and duration of contract	Total size of FMU (ha)	Current situation
U	CVG – Sierra Imataca	Public	April 02, 1997 (20 years)	157,141	Halted
N – 2	Corporación para el Desarrollo Forestal (CODEFORSA)	Private	November 24, 1987 (30 years)	129,749	Active Annual logging plan No. 12
N – 3	Sociedad Maderera Guayana (SOMAGUA)	Private	December 12, 1987 (30 years)	160,000	Halted
Altiplanicie de Nuria	Maderas Nuria	Public-Private	---	140,376	Active
N – 5	Industria Técnica de Madera (INTECMACA)	Private	December 12, 1987 (30 years)	160,000	Halted
N – 6	Industrializadora de Productos Forestales (INPROFORCA)	Private	June 03, 1991 (40 years)	137,144	Active
A	Alimentos Delta C.A (ALIDCA) ²	Private	January 07, 1993 (20 years)	336,500	Active
C – 1	Maderas del Orinoco (MADERORCA)	Private	November 03, 1995 (25 years)	131,900	Inactive
C – 2	Corporación Forestal Guayana (COFORGUA)	Private	Management Plan under development	127,277	----
C – 3	Consorcio Maderero Forestal (COMAFOR)	Private	November 11, 1995 (30 years)	126,645	Active Annual logging plan No. 8
C – 4	Aserradero Hermanos Hernández ³	Private	November 11, 1995 (30 years)	125,995	Active Annual logging plan No. 7
S – 3	Fundación La Salle	Private	Management Plan under development	137,460	----
Total area for forest management				1,870,187 (49% of IFR total area)	

¹The codification for FMU here refers to the location of the concessions: North (N); Centre (C) and South (S). ²Palm (*Euterpe oleracea*) management. ³Halted between 2010 and 2011 by the Ministry of the Environment due to technical problems regarding management plan failures. Source: Berroterán (2003); MinAmb (2008) and personal observations.

were particularly interested in analysing the degree to which the enterprises were able to comply with a partial set of reduced impact logging (RIL) guidelines, once to learn from the company's staff the reasons contributing to or constraining the adoption of RIL, and also to identify specific aspects of RIL guidelines that need improvement. Given the lack of adequate national official guideline for assessing compliance with management plans and RIL practices, we adapted an integration of field procedures detailed in Johns et al. (1998) and Sabogal et al. (2004) for tropical forests in the Amazon basin. This consisted of rapid random assessment checking of crown, stem, bark and root damage of residual trees (minimum DBH 10 cm), as well as of the size of five (5) logging gaps. This section of the assessment was performed between 1 and 2 months after harvesting in each concession. To increase the efficiency, the assessment of the verifiers was concentrated into a restricted number of operational units with a range of sizes from 20 to 40 ha, located in the current annual allowable cutting areas (ACA) of each concession. In addition, a scoring methodology of Appanah and Kleine (2000) was included in the assessment allowing for the measurement of progress made by the companies towards compliance with the selected C&I.

The rationale for the scoring system for all assessable verifiers is based on the contribution of each of them towards achieving sustainable forest management. In this work a greater importance was assigned to those verifiers linked to logging practices and monitoring. A score was given to each of the assessable verifiers defining a quantitative threshold to facilitate the interpretation of the collected information regarding the level of compliance. The sum of the scores of

each assessable verifier makes up the total score for the indicator. Furthermore, summing up the scores of the indicators resulted in the total score for individual criteria. The gathered information was directly discussed with forest workers in order to get their perception of these guidelines.

Finally, an assessment on social aspects of forest management was conducted. Based on the structure of Criteria 7 of ITTO (2005), referring to economic, social and cultural aspects of managed forests, several important indicators were grouped into four basic areas: 1) demographic and educational profiles of people, 2) general economic outlines of employment and incomes, 3) perceptions of the local inhabitants about forestry relevance for local livelihood, relationships with timber companies and workers' conditions and 4) local perceptions of ecosystem services (ES). In this work, the definitions and ES classifications of the Millennium Ecosystem Assessment (MEA, 2005) were used to identify the public awareness related to ES delivered by forest ecosystems.

Structured surveys were designed and conducted focused on two different stakeholders: a) local communities (both indigenous and native groups) living within the area of each concession and b) workers and managers of the timber companies. A total of 38 families (all non indigenous) were surveyed in five different small villages in the surrounding area of the CODEFORSA concession in northern Imataca. In the other two concessions, located along the 80 km road between Tumeremo town and Bochinche village, the same approach was followed for six indigenous homesteads of the Kariña group. In this case, a major proportion of the surveys (80%) were carried out

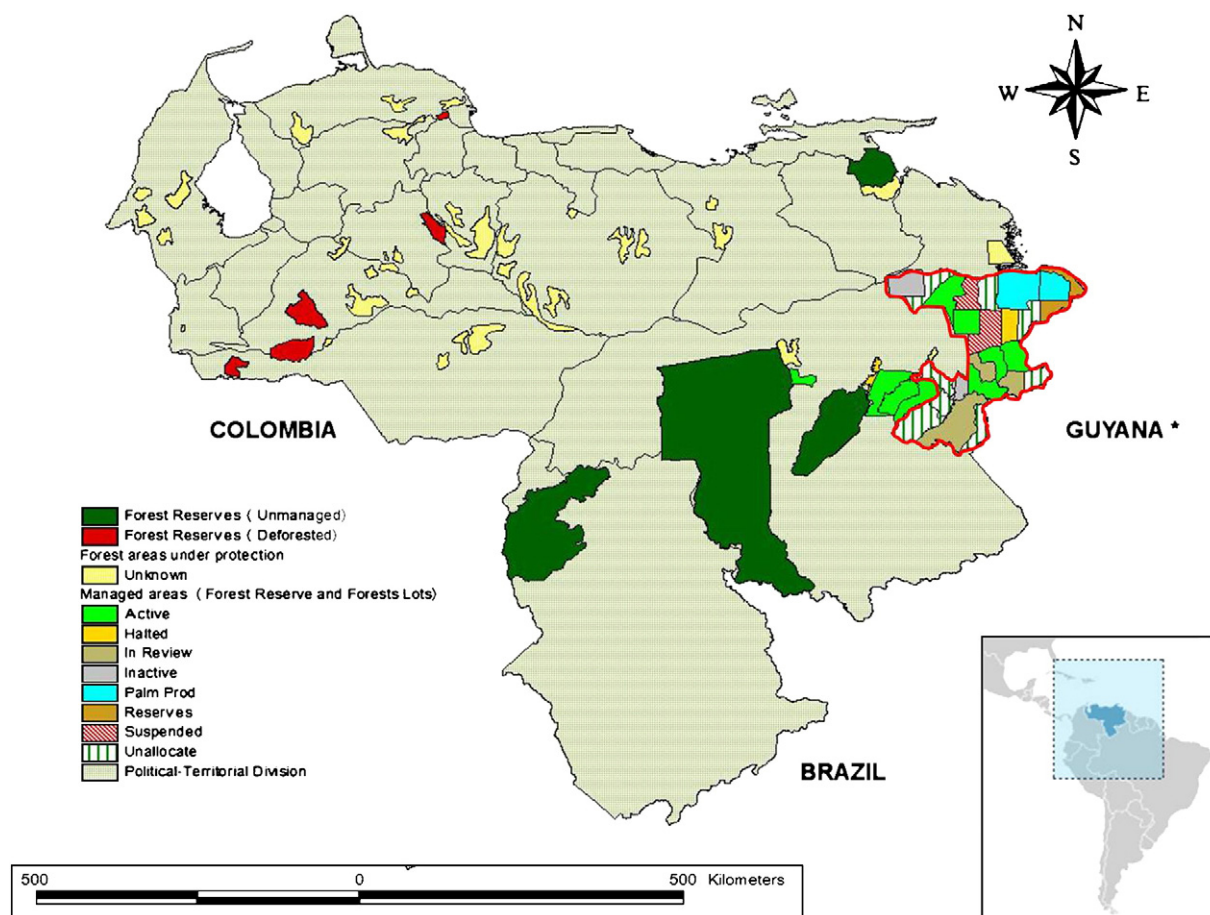


Fig. 1. Distribution and status of NFM in Venezuela. Map is based on GIS data from *GFW-VEN (2002)* and modified using information from *MinAmb (2008)*. The location of the Imataca Forest Reserve is highlighted in red.

with the community leaders ('caciques'), who are often responsible for the whole community. Informal dialogue and discussions were also very useful during this stage. Survey data were processed by means of a spreadsheet application.

3. Results

3.1. Scoring of C&I

The degree of compliance of the studied concessions in relation to the selected C&I for sustainable management is shown in *Table 4*. In terms of the achievement of the 13 selected indicators a range of fulfilment between 48 and 64% was estimated. Initial observations indicate a very similar performance on the implementation of management practices among the selected cases; however a slightly better performance, particularly regarding logging practices, is observed for COMAFOR. This may be associated with the professional capacity expressed by the higher number of qualified personnel working in the area. The social surveys revealed the occurrence of two related elements, such as temporary working contracts and a very low rate of company investment with respect to improving forest management. For instance, an economic analysis detailed in *Noguera et al. (2006)* for the Guayana region, reveals that forest concessions usually obtain high profits in the initial phases of logging operations with an inadequate reinvestment in other areas of management, such as better equipment and planning processes for logging operations.

Although boundary demarcation in the field is expressed here by using just one indicator, in terms of a clear presence of logging companies in such a complex area like IFR, the way in which concessionaries

publicly demonstrate their management activities is very poor. Public signs are usually used to demarcate concession limits and boundaries, including general information about companies, the main activities and some details about the contracts. Nonetheless, these are often only placed on permanent infrastructure without appropriate use in other critical areas such as nearby human settlements, conservation set-aside areas and areas assigned to silvicultural treatments. Official documentation about concession boundaries is also a matter of concern. On a regional scale, *Global Forest Watch (GFW-VEN, 2002)* already indicated that many concessions in the Guayana region have been established without the definition of geographic coordinates. In these cases, concession boundaries were identified by incidental and non-geographic points leading to a different estimation of the concessions' size. Consulted personnel from the timber companies argue that the main reason for not having an adequate system of boundary demarcation is the lack of economic resources and sufficient staff to perform this activity. In a broader analysis of compliance of RIL guidelines for two timber companies in the Brazilian Amazon, *Pokorny et al. (2005)* found that in one case the demarcation of working units in the field was poor and the main reason for rejection was that this procedure is considered as innovative in terms of planning pre-harvest operations.

In order to meet official regulations for harvesting, companies make a significant effort during pre-felling inventories. To assure that inventory procedures are applied in a consistent manner they need to be properly documented and approved by both the government institutions and the company managing the forest. Emphasis should therefore be on the existence and proper documentation of these inventory procedures. As a consequence, in this work, the presence of an inventory plan was considered good enough to assign the

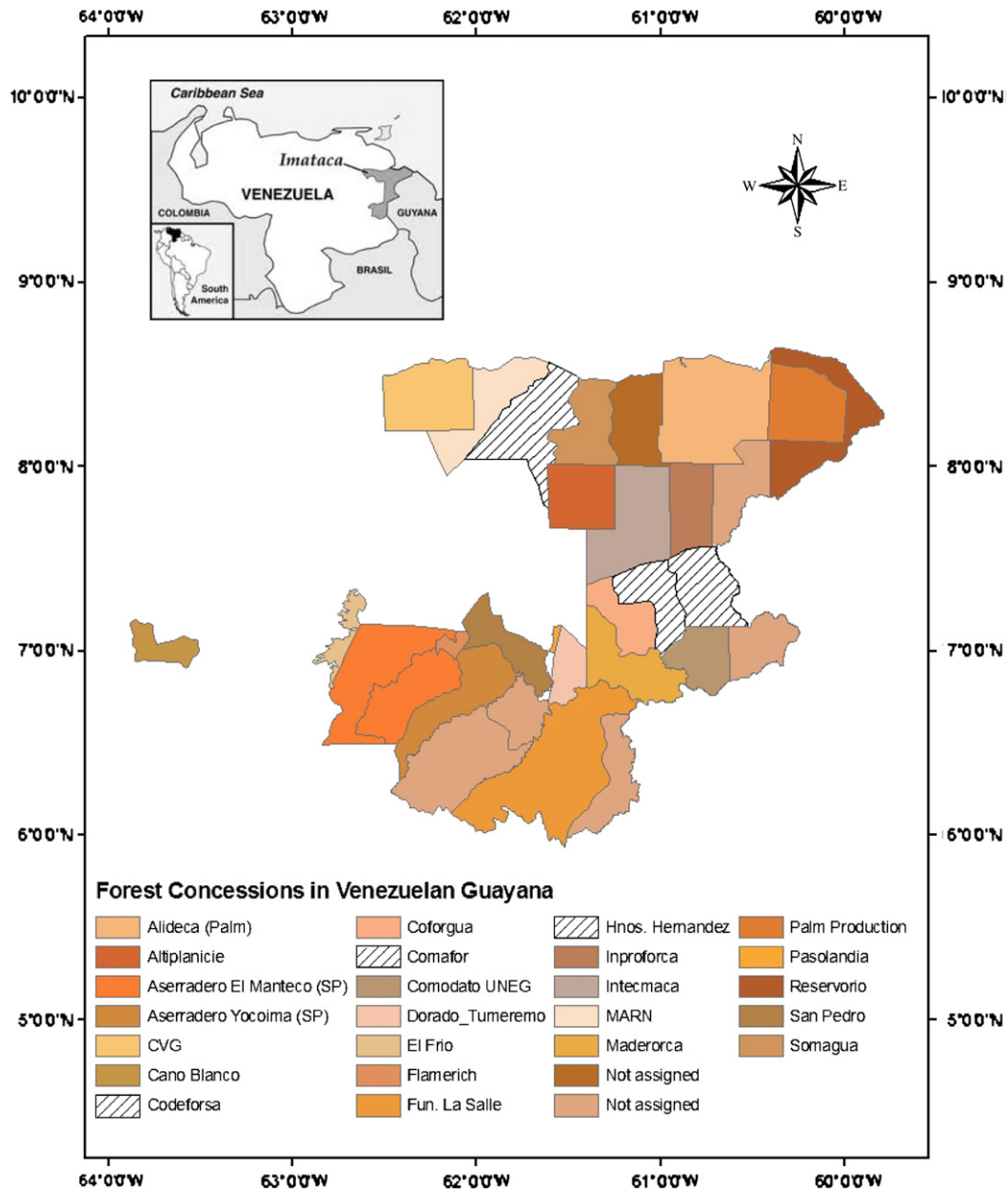


Fig. 2. Forest concessions in the Venezuelan Guayana and the selected cases used in this study. Map is based on GIS data from GFW-VEN (2002) and modified using information from MinAmb (2008).

maximum score (10 points for Verifier B.1.1). Yet a strong criticism remains. For example, Aicher (2005) undertook a deeper analysis and indicated that sampling intensity in most forest concessions was usually close to only 1% of the annual cutting areas considering a minimum diameter of 30 cm DBH.

The remaining indicators concerning pre-logging inventory are considered as well done by concessionaires, since this operation is critical during the development of annual cutting plans. So far, the results of these inventories are representative for the resources found in the FMU. Nevertheless, other studies (see Centeno, 1995; GFW-VEN, 2002) have identified significant constraints during this crucial stage of management. Inadequate wood volume estimations along with other critical issues of forest characterisation such as tree growth rates, species regeneration strategies, and wildlife assessments are typical management activities not being implemented. According to GFW-VEN (2002), by the year 2001 none of the concessionaires met the allowable cutting volume estimated in their management plans. Indeed, 38% of the operating concessions harvested

less than half of what was forecasted in the management plans, which may be interpreted as poor underlying inventory data. Other causes that require special attention are financial or market restrictions and critical delays in getting the approval for harvesting by government institutions.

Regarding logging effects, a proportion of close to 50% of the stand showed serious damage in all cases. Between two and five trees above 10 cm DBH showed severe damage for each logged tree, whereas five to ten trees showed low to medium damage. In a more detailed study in Imataca, Ochoa (1998) found that per logged tree, a mean of 15 trees presented severe damage. Depending on the density of commercial trees, a range between 150 and 685 m² in five logging gaps was measured, very far from other RIL results with a mean value of 130 and 280 m² (Jackson et al., 2002; Asner et al., 2004; Schulze and Zweede, 2006). Although there is an important research base of logging effects with emphasis on forests of the Venezuelan western plains (Kammesheidt, 1998; Kammesheidt et al., 2001), a very limited number of detailed assessments for Venezuelan Guayana exists,

Table 2
General outline of selected forest concessions.

Management parameter	Concession's name		
	CODEFORSA	COMAFOR	Hermanos Hernández
Mean annual allowable cut area (ACA) (ha)	3260	4000	3800
Mean annual commercial volume (m ³ year ⁻¹)	16,800	22,750	30,615
Number of commercial species ^a	40	40	41
Commercial volume (m ³ ha ⁻¹) ^b	10.2	10	13.3
Commercial tree density (tree ha ⁻¹) ^b	3.25	2.5	8
Minimum cutting diameter (MCD) (cm) ^c	50–60	40–50	40–50
Area officially assigned for conservation goals (ha) (% of concession area)	13,700 (11.2%)	7970 (6.3%)	24,800 (19.84%)

^a Management plans contain a large list of tree species classified according to commercial value, mostly in three groups.
^b In reference only to commercial species included in Group A (12 species) with the highest commercial value and logged more intensively.
^c Since 2009 a legal decree established a species-based MCD based on wood density of the most marketable tree species on a national scale.

offering an opportunity to strengthen the research to support/promote better logging practices. In terms of the selected verifiers linked to reducing the impact of logging operations (Indicator B.3) between 45 and 60% of compliance was detected. Pokorny et al. (2005) reported for two certified enterprises in the Brazilian Amazon a degree of compliance between 66 and 80%. Nevertheless, as was explained earlier, since this work consisted of a partial assessment it is worth mentioning that an evaluation of the complete RIL guidelines is needed to give more accurate estimations on how concessions in Imataca Forest Reserve are working.

Table 3
Selected criteria, indicators, verifiers and scoring methodology used in the evaluation of forest concessions.

Criteria	Number of indicators assessed	Indicator	Number of verifiers assessed	Verifier	Score range (points)	% of total
A. Resource security	1	A.1 Clear demarcation of boundaries in the field	1	A.1.1 Maintenance of external boundaries	0–70	18.91
				Total weight of indicator A.1	0–70	18.91
				Total weight for Criteria A	0–70	18.91
B. The continuity of timber production	4	B.1 Pre-felling forest inventory	2	B.1.1 Implementation of pre-felling inventories	0–10	2.70
				B.1.2 Pre-felling inventories results (existence and quality of information)	0–10	2.70
				Total weight of indicator B.1	0–20	5.40
		B.2 Monitoring of pre-felling inventory	2	B.2.1 Field verification	0–10	2.70
				B.2.2 Implementation of corrective actions	0–10	2.70
				Total weight of indicator B.2	0–20	5.40
		B. 3 Presence and implementation of harvesting plans	6	B.3.1 Tree marking for felling	0–20	5.40
				B.3.2 Prescriptions on cutting limits	0–20	5.40
				B.3.3 Directional tree felling	0–25	6.70
				B.3.4 Demarcation of riparian zones	0–25	6.70
				B.3.5 Damage to residual stands	0–20	5.40
				B.3.6 Supervision	0–130	35.13
				Total weight of indicator B.3	0–130	35.13
		B.4 Post-harvest monitoring	2	B.4.1 Assessments of areas after harvesting (documentation)	0–50	13.51
				B.4.2 Post-harvest surveys reveals the implementation of corrective actions	0–80	21.62
				Total weight of indicator B.4	0–130	35.13
				Total weight for Criteria B	0–300	81.09
				Total score	370	100

The numbers in bold indicate, on one hand, a range of minimum and maximum of points assigned to each item. On the other hand, indicate the proportion of points with respect to the total. Example: The maximum for criteria A is 70 pts which represents close 18.91% of the total scoring used in the study.

Different tasks encompassing the technical and in situ evaluation for monitoring of forest management by both logging companies and government institutions are perhaps the most critical issues for all selected C&I. In all three concessions, official reports and other important documentation related to revision, corrective actions and communications of forest management implementation were scant and in most cases absent from companies' offices.

3.2. Social perception of forest management in the Imataca Forest Reserve

3.2.1. Workers from timber companies

A common pattern between all three concessions was detected in terms of the workers' profile. In all cases, the number of employees is highly dependent on the degree of advancement of the management plan in each concession. Obviously, during logging operations (from December to May) the total number of workers increases reaching a mean of 40 people. Temporary contracts and inadequate forms of employment remain, which severely affect the way management is implemented. As the social survey revealed, the forestry staff consulted often have little or no incentive to improve forestry activities established according to contract guidelines. For example, less than 30% of workers surveyed expressed concern about the concept of sustainable management and the fate of the forests. Revenues and salaries were indicated as the most critical issue. In the case of Imataca concessions, forestry staff is often under-trained and under-paid. Under such circumstances, in spite of having an official management plan including a high number of regulations and instructions, the extent to which these regulations are followed is unknown.

The management staff is also a matter of concern. Both public (government) and private (concessionaries) personnel in charge of supervision and management planning also experience similar conditions on a labour scale. A common response of people working in the Ministry of the Environment in charge of monitoring tasks for all

Table 4
Scoring of selected C&I in three forest concessions in Imataca Forest Reserve.

Criteria	Indicators	Score/concession			
		Range (points)	CODEFORSA	COMAFOR	Hermanos Hernández
A. Resource security	A.1 Clear demarcation of boundaries in the field				
B. The continuity of timber production	A.1.1 Maintenance of external boundaries	0–70	40	45	35
	B.1 Pre-felling forest inventory				
	B.1.1 Implementation of pre-felling inventories	0–10	10	10	10
	B.1.2 Pre-felling inventory results (existence and quality of information)	0–10	5	5	5
	B.2 Monitoring of pre-felling inventory				
	B.2.1 Field verification	0–10	5	10	5
	B.2.2 Implementation of corrective actions	0–10	5	5	5
	B. 3 Presence and implementation of harvesting plans				
	B.3.1 Tree marking for felling	0–20	15	15	15
	B.3.2 Prescriptions on cutting limits	0–20	15	15	15
	B.3.3 Directional tree felling	0–20	10	15	5
	B.3.4 Demarcation of riparian zones	0–25	10	10	10
	B.3.5 Damage to residual stands	0–25	10	10	5
	B.3.6 Supervision	0–20	10	15	10
	B.4 Post-harvest monitoring				
	B.4.1 Assessments of areas after harvesting (documentation)	0–50	25	30	20
	B.4.2 Post-harvest surveys revealing the implementation of corrective actions	0–80	45	50	40
Maximum score		370			
Concession score			205	235	180
% Compliance			55.40%	63.51%	48.64%

The numbers in bold indicate, on one hand, a range of minimum and maximum of points assigned to each item. On the other hand, indicate the proportion of points with respect to the total. Example: The maximum score for all items was 370 points. One concessions obtained 205 which indicates a 55.4% of compliance with guidelines.

concessions offered the same trend, where forestry departments and ministries are often underfunded and ill-equipped to supervise and monitor logging activities and forest management on forest concessions, with little field capability for on-the-ground inspection. As a consequence, in many cases this can lead to an increase of vulnerability to illegal actions, such as bribery to approve logging plans or approve scaling records and timber volumes without accurate field inspection.

3.2.2. Local communities

Setting aside the type (indigenous or native) of local communities living near or inside the concession areas, the conditions of different degrees of poverty is shared in all cases. The lack of basic services (clean and potable water, appropriate housing and stable sources of income) is more evident in the case of the COMAFOR and Hermanos Hernández concessions. The conditions and dynamics of the indigenous groups in Imataca is documented and analysed in other studies (Miranda et al., 1998; GFW-VEN, 2002; Berroterán, 2003). Even so, the surveys showed how most of 'Kariña' population maintains traditional forms of land-use, based on subsistence activities of fishing, hunting and slash and burn ('conucos') agriculture. Based on recent studies and the results of the surveys, close to 900 inhabitants live in the six small villages assessed during this study.

People living in northern parts of Imataca are more closely related to forestry and associated activities (wood processing for furniture and handcrafting). In fact, most workers employed in the studied concessions come from the towns of Upata and El Palmar, both located to the north of the reserve. In this same area, forest related work accounts for at least 1.5% of the economic incomes for local communities in the surrounding areas of CODEFORSA. On a municipal scale (Municipio Padre Pedro Chien), extensive cattle ranching and low productivity farming comprise nearly 80% of incomes. Remarkably, our findings revealed that only 20% of people acknowledged the existence of a private logging company regime. In most cases, concessions are considered as negative forces leading to an overexploitation of forest resources without benefits for the local people.

In contradiction, despite the apparently very low relevance of the forest concessions for local communities, it has been documented that between 100 and 120 small carpenteries and other small wood-based workshops are located in the area of influence of the CODEFORSA concession (Berroterán, 2003). Official estimations made by governmental agencies indicate that at least an annual volume close to 20,000 m³ is being processed in these facilities, equivalent to the annual production capacity of forest concessions.¹ Since according to the management plans and company, once the wood is logged within the concession area, the total volume is transported to saw-mills located far from the FMU, this has been interpreted as likely evidence of informal or illegal activities. Nevertheless, there are no accurate estimations of the extent of illegal logging or analysis of how such complex mechanisms are working in the area.

The situation of concessions located in the central part of the IFR is very similar. Social surveys revealed a strong trend toward the perception of a negative impact of concessions on some of the resources used by the local populations. Yet, an additional problem in this area is related to mining activities with an emphasis on gold extraction. Legal concessions granted for mining have been awarded since the 1990s (Miranda et al., 1998) and increased over the last decade (Berroterán, 2003). Specifically in the case of the Hermanos Hernández concession, there is a dangerous conflict for land use in the area. Legal and illegal mining practices are actually taking place within the same area. Local leaders voiced concerns that the main consequences can range from simple administration issues to severe security conflicts between logging company and miners. The surveys' findings also showed that for many people from the local settlements in this part of Imataca, a combination of temporary and underpaid contracts exist for participation in both logging and gold mining activities.

In addition, a decrease in small-scale mining due to lower gold prices has been documented (GFW-VEN, 2002). However, in recent years, due to a series of erroneous governmental policies aimed at the development of a broader small-scale mining activity, where incentives for

¹ Leonardo Lugo (Director of Forest Division at the Environment Ministry), personal communication.

equipment were offered, an important increase in illegal activities in several parts of the Guayana region has been documented, which includes IFR (Lozada, 2007). Although, small-scale mining is a regionally important activity in the Bolívar State, as it generates employment and provides an economic alternative for low-skilled workers during times of recession, such a complex scenario has undermined how the land is being managed. Moreover, the fear of a massive spreading of illegal logging and gold mining, combined with poorly planned forest management in other parts of the Guayana region, has gained relevance among policy makers, leading them to evaluate other possibilities including a strong restriction on new forestry concessions and the creation of new protected areas such as national parks.

The assessment made on the social perception of ecosystem services (ES) served to detect important trends to partially explain the complex relationships between people and forests in IFR. Indistinctive from the area assessed in the reserve, in all cases people tend to recognise provision services as being the most important delivered and used. For instance, wood, fibre, potable water and food comprise a very selective group of services considered as being essential to sustain basic activities in all settlements consulted. A hierarchical pattern of ES significance was also obtained. In the case of northern Imataca, where most of the population is represented by non indigenous groups, the consideration about regulation services followed in relevance. Climate and water regulation were valued as the most important services in this category. On the other hand, indigenous groups settled in central IFR remarked on the traditional and historical use and heritage values of the forest ecosystems (cultural services). Similar patterns are being reported since the publication of the Millennium Ecosystem Assessment (MEA, 2005). However, the main drivers of degradation are different when the northern and central parts of Imataca are compared. Low productive agriculture combined with extensive cattle raising, as well as poor logging practices, threaten the stability of the forest ecosystems in the northern part of the reserve. Secondly, in the central part, the people surveyed and the public evidence clearly show that gold mining and unsustainable logging are the two major drivers of change in this area.

4. Discussion

Our findings relate a widely known and documented situation for many tropical countries where forest management based on the concession model face serious limitations and constraints (Gray, 2002). However, currently there is no documented experience about a total or partial application of C&I in Venezuela. In addition, the discussions about how natural forests are being managed under the concession model and the social perceptions of forest management and the ecosystem services has been very scanty or absent. The following paragraphs seek to present the discussion of main results obtained after examining the compliance of sustainable forest management guidelines in three of the concessions of the Venezuelan Guayana.

4.1. Reduced impact logging is urgent

The assessment made on the criteria 'presence and implementation of harvesting plans' (B.3) included key elements of both the pre and post logging phases of management. Most limitations observed are closely related to a poor planning process. Very low quality practices remain without proper execution of RIL techniques. For a very long time, the lack of a well-designed structure of incentives to promote better logging practices characterised the relationship between the national government and private companies. In addition, there is a misconception in IFR logging companies, clearly shown in Putz et al. (2000), which indicates that from the companies' perspective there is nothing wrong with the current practices. Undoubtedly, the lack of accurate location maps of commercial trees seems unacceptable, which along with proper road planning will in turn have a positive impact on how forest management could be

applied. Two cases (COMAFOR and CODEFORSA) have made some significant efforts to improve this situation in recent years, but without any systematic implementation over time.

Perhaps one of the most important arguments against industrial forestry in Venezuela is related to the ecological effects of logging operations. Despite the political decisions about how national production forests are going to be managed in the future, the adoption of better logging practices in Venezuela is imperative. Whether we talk about industrial private concessions, community forestry or any other mixed form of management it is unquestionable that ecological and social effects of logging must be reduced. Since 2008, new forest legislation (Venezuela, República Bolivariana de, 2008) includes novel mechanisms of incentives to those activities where RIL is applied. These include tax concessions and financial support (credits) to improve equipment.

Basic implementation of RIL requires detailed inventories in which the trees to be harvested are mapped, marked, and measured. Other additional and very important practices include adequate road planning and improving workers' labour conditions through training and education (Putz et al., 2000). Our findings revealed that none of these are systematically applied in forest concessions in Venezuela. Yet a single example applied on a pilot scale is reported in Noguera et al. (2007) for one concession in the Guayana region. However, updated information indicates that this experience recently stopped due to economic reasons. In all cases, especially for guidelines related to complex technical activities such as mapping of commercial trees and directional felling, all three concessions suffered from a lack of trained and qualified personnel. So far, Venezuela lacks an appropriate training framework to address this critical issue of RIL in natural forests.

4.2. We need more than management plans

The adoption of management plans as a novel tool to improve and control logging in Venezuela was recognised as a promising experience during the 70s and 80s, for moving towards better management practice for national production forests (Dourojeanni, 2000; Kammesheidt et al., 2001; Torres-Lezama et al., 2008). Nevertheless, many of the regulations once included never materialised according to the original objectives and goals, or at least were not applied systematically. The sole existence of management plans narrowed the need to structure a more balanced process between the planning, implementation and control of management activities. For instance, a proposed in depth revision during the fifth year on how the management was being implemented never took place (cf. Aicher, 2005). The structure and monitoring of management plans for the Guayana region remain the same, despite important differences between the forest ecosystems, socio-economic conditions of local communities, and increased concern about biodiversity issues and ecosystem services. A similar conclusion is reported in Cerutti et al. (2008) after the analysis of more than 40 management plans in the production forests of Cameroon. As with our studied cases, the government institutions have not yet succeeded in implementing effective minimum sustainability safeguards in order to strengthen the great importance of planning during forest management.

In the case of Venezuela, the potential of international processes and corresponding tools, such as C&I, for sustainable forest management has often been underestimated. In spite of the recent debate about the effectiveness of forest certification schemes (e.g. Nasi and Frost, 2009), it has been recognised as a useful mechanism towards improving several elements of forest management (Cashore et al., 2006). In this regard, Venezuela accounts for zero surface of NFM certified under any international scheme. As a consequence, for different reasons including economic constraints (Noguera et al., 2006), ecological effects (Ochoa, 1998; Lozada, 2007), social conflict (Rojas-López, 2007) or a lack of guidelines and adequate formulation of policies for

forest management on a national scale (Torres-Lezama et al., 2008), increased scepticism about the management of natural forests has grown.

Social surveys revealed an almost total disconnection between logging companies and local communities. Following the arguments of Nepstad et al. (2005), Venezuelan Guayana comprises an area where sustainable management should be encouraged in those areas where communities are present, in order to take advantage of mutually beneficial opportunities. This process could be implemented through a simple sharing of revenues coming from timber harvesting allocated to local communities to the more complex co-management scenarios between local communities and timber companies. This could offer new opportunities for the commercialisation of non-timber forest products used by people, as was detected in our surveys. As a consequence it is believed that the incorporation of social needs into the monitoring process, through a broader participation of communities in the decision-making process, could assist in a better shaping of forest management practices.

4.3. Increasing monitoring capacity

Significant deficiencies in the quality of harvesting operations are mainly the result of insufficient monitoring efforts. A weak institutional capacity persists in many areas of the Venezuelan forestry sector, including the Imataca Forest Reserve. In spite of new instruments for assigning institutional functions regarding forest management, conflicting ministerial interests and weak institutional coordination have hampered forest conservation efforts and the development of the forestry sector. It is fair to say that monitoring of all aspects related to management in natural production forests is probably the most unsuccessful activity. To solve this, it is crucial to design well-balanced schemes where third-party and independent institutions take part. Based on an adaptive scenario, monitoring will help evaluate the outcomes of actions, to learn lessons and to apply them to facilitate better implementation of management strategies (Nasi and Frost, 2009).

The scoring of selected C&I used here offers new approaches in order to plan the implementation of a more complete set of guidelines aimed at the systematic application of a site-specific tool to evaluate the performance of management. Here, research is essential to improve our knowledge on essential and critical elements of forests under management. These include not only the technical issues of logging, as mentioned earlier, but also a definition of strategies to assure a greater participation of rural resource users and other stakeholders in conservation and management research (Chazdon et al., 2009). Although this is a partial study in terms of the evaluation of C&I, this work revealed the fundamental importance of systematic, objective and continuous monitoring to guarantee the quality of basic forest operations.

5. Concluding remarks

The assessment revealed valuable information with regards to the state of the implementation and quality of forestry operations in three concessions in the Imataca Forest Reserve, and identified important trends in key aspects of forest management. On a national scale, after four decades of forestry activities under the concession model, and contrary to original expectations, the results of NFM have not contributed to the development of a strong national forest sector, to the well-being of people living in or near the forests and to reducing the ecological effects and loss of biodiversity and other important ecosystem services. After a very low performance of NFM in the case of the western plains of the country, forest conversion was not a surprise. Nevertheless, given the area of undisturbed production forests still remaining in the Guayana region we urge a complete overhaul of the forest concession model where the management of wood and other important benefits are viewed on an ecosystem-based approach. Complex issues such as the maintenance of a sustainable flow of ecosystem services in a climate change scenario could be

better accomplished using holistic and landscape-based approaches (Sayer and Maginnis, 2005).

Setting aside the options of creating new and strict protected areas where productive activities are being undertaken like IFR, small and modest efforts are needed to shape new ways of managing highly diverse and complex ecosystems. For example, small-scale forestry (SSF) constitutes an opportunity in many countries to provide goods and services that cannot be produced through industrial and large-scale operations, and to promote poverty alleviation and development (Torres-Lezama et al., 2009). It is believed that SSF could enhance the relevance of ecosystem services for local livelihood through the implementation of multiple-use choices combining different productive activities such as NTFP, ecotourism and other ecosystem services-based scenarios.

Are Venezuelan production forests being managed in a sustainable manner? Revised documentation and field experience reported in this work indicate a trend towards a negative response. Results undoubtedly show that despite having a long experience in forest management under the concession model, Venezuela needs a complete revision of traditional forms of management, including different approaches for planning and towards better social involvement of local communities. Although this situation has been widely documented among tropical countries, the main goal of this work was to integrate an updated analysis of the forest concession model through a historical examination of practices and a site-specific analysis on three of the very few concessions still active. In conclusion, the statements discussed in this paper can contribute to a revision of the current situation of national forest management by offering decision-makers a range of options for the sustainable development of the Guayana region.

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