

Forest resources in Venezuela: current status and prospects for sustainable management

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After three decades of natural forest management and plantation forestry in Venezuela, the strengths and weaknesses of these practices are examined. The authors propose a complete overhaul of the way forest resources have been managed in Venezuela. This should lead to a strengthened forest sector, the development of new policies on forest concessions, more effective integration of local communities and lower impacts on the natural forest, amongst other objectives.



Rancho Grande cloud forests in Henri Pittier National Park.
Photo E. Vilanova.

RÉSUMÉ

RESSOURCES FORESTIÈRES AU VENEZUELA : ÉTAT ACTUEL ET PERSPECTIVES POUR LA GESTION DURABLE

À l'issue de trois décennies de gestion de forêts naturelles et de plantations forestières au Venezuela, nous étudions les points forts et les points faibles des pratiques utilisées. Nous proposons des solutions qui permettent d'avancer vers des modes de gestion forestière durables. Plus de trois millions d'hectares de forêts naturelles ont été mis sous concession à long terme. Cependant, dans les plaines occidentales, la forêt a pratiquement disparu en raison des fortes pressions exercées par les activités humaines et des faibles résultats de la gestion forestière. Malheureusement, les aspects sociaux sont les moins étudiés. Le Venezuela est doté de plus de 500 000 ha de plantations industrielles, dont le potentiel reste à réaliser pleinement. La contribution du secteur forestier au Pnb du pays n'a pas augmenté et reste très limitée (1%). La plupart des méthodes de régénération forestière adoptées sont axées sur la transformation des forêts. Cette approche a suscité de fortes critiques sur le plan de la conservation de la biodiversité. De même, l'application sans discernement de diamètres minimaux de coupe, de rotations inadaptées et de coupes sélectives – caractérisées par le manque de planification et un impact important sur l'environnement – ont dégradé la forêt et mis en doute la viabilité écologique et économique du système en vigueur. Pour finir, nous proposons une révision complète des modes de gestion forestière au Venezuela. Cet effort devrait permettre, notamment, de renforcer le secteur forestier, d'élaborer de nouvelles politiques pour les concessions forestières, de mieux intégrer les communautés locales et de diminuer les impacts sur la forêt naturelle.

Mots-clés : sylviculture de plantation, impact environnemental, gestion forestière durable, forêt tropicale, Venezuela.

ABSTRACT

FOREST RESOURCES IN VENEZUELA: CURRENT STATUS AND PROSPECTS FOR SUSTAINABLE MANAGEMENT

After three decades of natural forest management and plantation forestry in Venezuela, we examine the strengths and weaknesses of these practices and propose solutions to move towards sustainable forest management. More than three million hectares of natural forests have been signed over under long-term concession agreements. In the western plains, the forest has almost disappeared, due to intense pressure from human activity and the poor results of forest management. Unfortunately, social aspects have received the least attention. On the other hand, the country has over 500 000 ha of industrial plantations, but their potential is yet to be fully exploited. Furthermore, the forest sector's contribution to the country's GNP has not increased, remaining extremely low (1%). Similarly, most of the forest regeneration methods that have been adopted focus on forest conversion. This approach has aroused strong criticism around the issue of biological diversity conservation. Likewise, the indiscriminate use of minimum felling diameters, inappropriate felling cycles and the application of selective logging methods – characterized by poor planning and severe environmental impacts – have led to forest deterioration, thus bringing the ecological and economic sustainability of the system into question. Finally, we propose a complete overhaul of the way forest resources have been managed in Venezuela. This should lead to a strengthened forest sector, the development of new policies on forest concessions, more effective integration of local communities and lower impacts on the natural forest, amongst other objectives.

Keywords: plantation forestry, environmental impact, sustainable forest management, tropical forest, Venezuela.

RESUMEN

RECURSOS FORESTALES EN VENEZUELA: ESTADO ACTUAL Y PERSPECTIVAS PARA EL MANEJO SOSTENIBLE

Después de tres décadas de manejo del bosque natural y forestería de plantaciones en Venezuela, se examinan las fortalezas y debilidades de estas experiencias y se proponen soluciones orientadas hacia el manejo forestal sostenible. Se han otorgado más de tres millones de hectáreas de bosques naturales en concesiones a largo plazo. En los llanos occidentales del país, el bosque casi ha desaparecido debido a la fuerte presión humana y los escasos resultados del manejo forestal. Desafortunadamente, los aspectos sociales recibieron poca atención durante este proceso. Por otra parte, se cuenta con más de 500 000 hectáreas de plantaciones industriales; sin embargo, su potencial todavía no se ha desarrollado. Además, la contribución del sector forestal al PIB del país no ha aumentado, permaneciendo extremadamente bajo (1%). Igualmente, la mayoría de los métodos de regeneración del bosque que han sido adoptados se han enfocado en la transformación del mismo. Esto ha generado fuertes críticas alrededor de la conservación de la diversidad biológica. Asimismo, el uso indiscriminado de los diámetros mínimos de corta, inapropiados ciclos de corta y la aplicación de métodos selectivos de aprovechamiento – caracterizados por una deficiente planificación y un alto impacto ambiental? ha conducido al deterioro del bosque y arrojado dudas sobre la sostenibilidad económica y ecológica del sistema. Finalmente, se propone una revisión completa de la manera en que los recursos forestales han sido manejados en Venezuela. Este esfuerzo debería conducir al fortalecimiento del sector forestal, el desarrollo de nuevas políticas de concesiones forestales, una incorporación más efectiva de las comunidades locales y un menor impacto sobre los bosques naturales, entre otros fines.

Palabras clave: forestería de plantaciones, impacto ambiental, manejo sostenible del bosque, bosques tropicales, Venezuela.

Introduction

Given that Venezuela's economy is industry-oriented and mainly dependent on the oil sector, forestry development is not a priority (FAO, 2004). Despite this, Venezuela is one of the countries having made the longest continuous effort towards natural forest management (NFM) under long-term concession tracts in Tropical America. During the 1970s, the introduction of concessions represented a significant advance in the Latin American region. However, inappropriate forest management and administration practices were unable to maintain the western lowland forests as viable sources of timber (KAMMESHEIDT *et al.*, 2001). Furthermore, after more than 30 years of public and private efforts, planted forests still only cover less than 1% of the national territory. The most important achievement in plantation forestry has been the cultivation of more than 500 000 ha of Caribbean pine (*Pinus caribaea* Morelet) in the eastern lowlands. The potential of these plantations has not been fully developed and the sustainability of its ecosystem remains uncertain (CEDEÑO *et al.*, 2001; TORRES-LEZAMA *et al.*, 2001a).

Contrary to expectations, the results of forest management have not contributed to the development of the national forest sector, to the well-being of people living in or near the forests, or to the forests' permanence. In 2000, the contribution of forestry activities to national GDP was still only 1%, one of the lowest in Latin America (FAO, 2004). In contrast, the oil sector generated 27% of GDP and represented a significant source of growth for the manufacturing and service sectors (<http://www.bcv.org.ve>). In this paper, we begin by examining the country's forest resource base and conservation status, including the socio-economic and political aspects that have been affected by forest loss. We offer a frank and critical analysis of the efforts made and difficulties experi-

enced over more than 30 years of implementing NFM and plantation forestry. We then turn to possibilities for sustainable management based on legal, institutional, ecological and socio-economic criteria. Finally, we discuss the prospects for forest development and sustainable management in Venezuela.



Tree buttresses and diversity of understory plant species in the Caparo Forest Reserve.
Photo E. Vilanova.

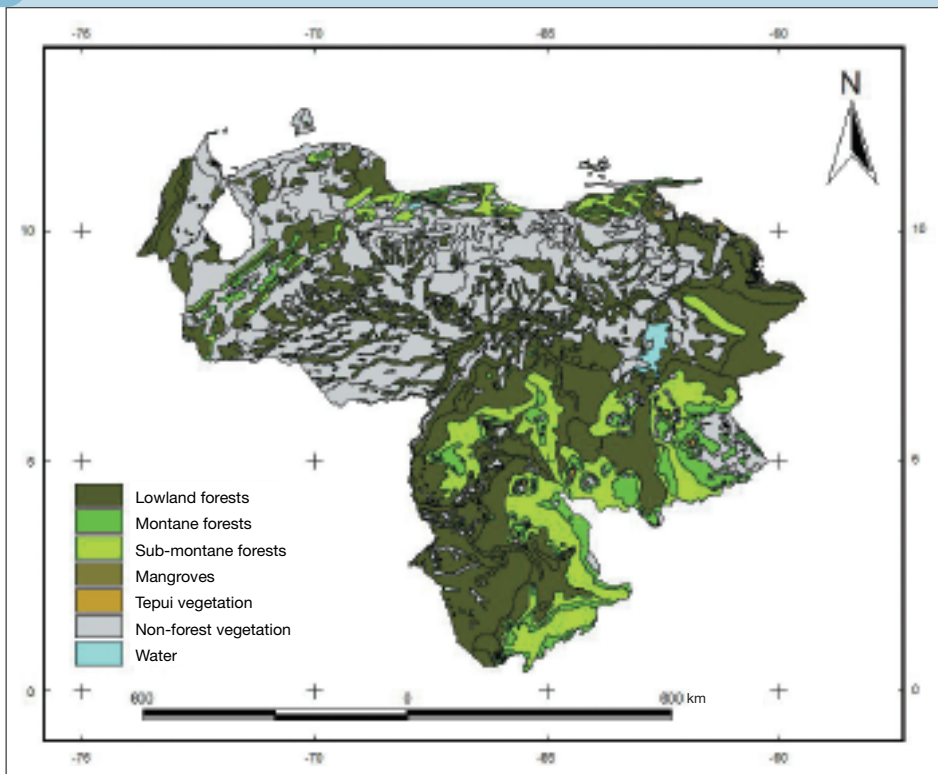


Figure 1.

Distribution of the main forest types in Venezuela. Source: based on GIS data of GFW (2002). Note: The map does not include Guyanan territory claimed by Venezuela under the Geneva Agreement of February 7, 1966.

Natural forest cover and protection

Venezuela is a South American country covering an area of 912 050 km². It is roughly divided into three regions: a) the coastal and mountain region, which covers about 20 percent of the total land area but supports the majority of the population (85%); b) the flat, alluvial region of the Orinoco River plains, covering about one third of the country; and c) the Guyana region (Bolívar and Amazonas states), which covers the southern half of the national territory and is still very sparsely populated. Venezuela is one of the ten countries with the largest tropical forest areas in the world and ranks fifth in South America (WRI, 2001). Moreover, Venezuela ranks fifth at worldwide level in terms of plant species diversity, with almost 17 000 species of which 8 000 are endemic (AGUILERA

et al., 2003; WRI, 2001). This suggests that the country has enormous potential for biodiversity use.

The distribution of Venezuela's main forest types is shown in Figure 1. The predominant forest type is moist lowland evergreen forest, followed by montane forest, seasonal evergreen, dry deciduous and swamp forests. Other forest types, which are found in smaller areas and are of great importance in terms of environmental services and biological diversity, are the riparian forests and mangroves. Further details can be found in HARCOURT and SAYER (1996) and AGUILERA *et al.* (2003). Other more detailed maps include Huber and Alarcón's map (1988), which distinguishes 150 vegetation types.

Forest cover in Venezuela had varied greatly over the last two centuries. At the beginning of the 20th century, the forests to the north of the Orinoco River had expanded due to a drastic reduction in human population and the abandon of arable lands that followed the long Independence and Federation

wars. Meanwhile, southern forests, in the Guyana region, remained undisturbed (VEILLON, 1976). In contrast, during the last 50 years, the area north of the Orinoco River has suffered intense deforestation, linked especially to fast-expanding agricultural colonization. From 1950 to 1988, more than six million hectares of forests were lost (VEILLON, 1976; GFW-VEN, 2002). This has transformed the area's original continuous forest cover into a highly fragmented landscape. In recent years, the pressure on Guyana's forests has increased still further (GFW-VEN, 2002).

Nevertheless, due to the lack of reliable, up-to-date information, it is difficult to determine the country's current forest size and recent changes in its forest cover. As of 2000, Venezuela's natural forest cover was estimated at 43.78 million hectares (http://earthtrends.wri.org/pdf-library/country_profiles/for_cou_862.pdf), or 48% of its total area. Nowadays, most of its forests (90%) are located in the Guyana region, whereas in 1950, 36% were in the north.

According to the Venezuelan government, the main causes of deforestation are "agricultural frontier expansion, illegal logging, permanent colonization of forests, poor planning of mining activities, and forest fires" (MARN, 2002). Furthermore, the building of river dams in Guyana, which supplies about 70% of the nation's electricity, has had a negative impact on a large area of forest. Forest degradation should be mentioned too: this is often associated with unsustainable logging in humid forests, fuelwood collection, small-scale gold-mining and overgrazing in dry forests. In general, the lack of awareness of environmental issues is reflected in immense environmental damage.

The country has a complex "system" of natural protected areas (NPA). These NPAs are managed for specific purposes according to special laws, and were designated as *Áreas Bajo Régimen de Adminis-*

Table I.
Areas under Special Administration (ABRAE) in Venezuela
and corresponding categories of IUCN Natural Protected Areas.

IUCN category	ABRAE category	Surface (ha) *	National surface (%)
II	National parks	13 559 578	14.80
III	Natural monuments	4 276 178	4.67
IV	Wildlife refuges	53 474	0.07
	National hydrological reserves	1 740 783	1.90
	Subtotal	1 794 257	1.96
V	Wildlife reserves	71 857	0.08
	Protected zones	12 859 531	14.03
	Subtotal	12 931 388	14.11
VI	Forest reserves	11 812 606	12.89
	Forest lots	1 224 626	1.34
	Forest areas under protection	3 387 889	3.70
	Biosphere reserves	9 602 466	10.48
	Subtotal	26 027 587	28.40
NA	Other 11 figures	6 116 409	6.68
Total		64 705 397	70.6

Source: adapted from Marn-Dgb, 2004: Anuario estadísticas forestales n° 7 (2000-2001); Marn-Dgb, 2001: Boletín estadístico forestal n° 3, año 2000, Caracas, Venezuela.
* Overlapping areas are included.

tracción Especial – ABRAE (Areas under Special Administration). 25 categories are defined under national legislation. As of 2004, 383 ABRAEs had been established, representing approximately 46% of the national territory, with 72% of this area covered by forests (GFW-VEN, 2002; BEVILACQUA *et al.*, 2006). However, a new legal framework has established two kinds of ABRAEs: natural protected areas (national parks, natural monuments, wildlife sanctuaries, wildlife refuges, protected zones and biosphere reserves), and “special use” areas which include all the other ABRAE categories. Table I shows the total surface areas of the different kinds of NPA currently existing in the country, and the correlation between established national categories and the World Conservation Union’s categories. As we can see, many categories (totalling 6.7% of the ABRAE surface area) cannot be assigned to IUCN categories.

However, the reportedly high percentage of legally protected areas says little about the quality of NPA management. In fact, many weaknesses and deficiencies in NPA management have been pointed out, such as the overlapping of incompatible protected area categories, inadequate or controversial zoning plans, and budget and personnel limitations (BEVILACQUA *et al.*, 2006)

Since 1950, the national government has reserved 16 425 121 ha of public land for timber production as Permanent Forest Estates (PFE) (MARN, 2001). It is estimated that these PFE have suffered forest losses of 2 to 3 million hectares since then. In the proposed *Plan Nacional de Desarrollo Forestal* (National Forestry Development Plan) it is estimated that only 5 million ha of the PFE (30.44%) may be brought under management for sustainable production of timber, palm hearts, palm fibres and other plants and diverse products (MPD, 2002).

Whereas the human population grew at an annual rate of 2.5% during the 1980s, and 2.3% during the 1990s (<http://www.ine.gob.ve/poblacion/distribucion.asp>), GDP grew by only 1% from 1980 to 2000 (FAO, 2004). This decline in economic growth affected socio-economic conditions and, consequently increased human pressure on forest resources. Land area per capita decreased from 8.3 ha in 1970 to 3.5 ha in 2000 (FAO, 2004).

The acute inequality between agricultural landowners and those who engage in illegal agrarian colonization has had a strong effect on PFE losses in the country’s western lowlands. In Venezuela, 9% of owners possess 87% of the land. Even worse, 85.5% of owners have farms covering less than 50 ha, which represents barely 10.7% of the total, whereas 1% of owners have farms covering more than 1 000 ha, which, altogether, represent 46.5% of available land (DELAHAYE, 2001). Politicians and landowners take advantage of poor people in need of land in order to encourage encroachment into forest reserves. In the past, invaded lands have been *desafectadas* (set aside) by the national congress in order to pursue causes of “social interest”. In order to move out these areas, settlers receive a payment from the central government. Strikingly, the Agrarian Reform Law (1960) had a negative impact on the permanence of forest resources (HARCOURT, SAYER, 1996). This law recognized “land improvements” (*bienhechurías*) in these public lands. Ultimately, the land was again concentrated back into the hands of landowners who bought it from colonizers (ROJAS-LÓPEZ, 1993). Consequently, this “*desafectaciones*” policy became absolutely inappropriate as a way of reducing human pressure on the forest.

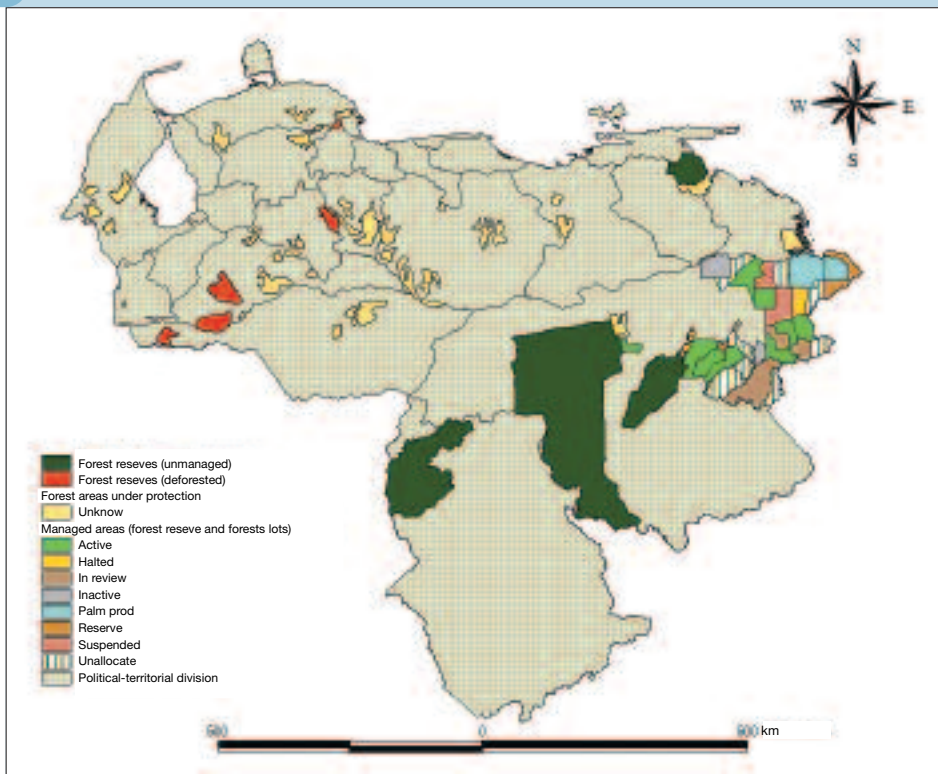


Figure 2.
 Distribution and status of natural forest management in Venezuela.
 Source: based on GIS data from GFW (2002).

Natural forest management and sustainable use of forest products

Edible forest products have been gathered in the Venezuelan Amazon since ancestral times. It is also well known that in the early 20th century, latex harvesting from the rubber tree (*Hevea brasiliensis*) in the Amazon basin had a major impact around the world. Exporting fibre from the *Leopoldinia piassaba* palm was also an important activity in this region.

Forest harvesting in the 20th century, however, was dominated by mechanized logging. This started as a commercial activity in the early 1920s, in the semi-deciduous humid forests of the western lowlands. Logging was carried out under the legal provisions of annual felling licenses. Official regulations were quite simple and disregarded the sustainability of such activities and their future impact on resource availability. In short, minimum felling diameters (MFD) were prescribed and an annual cut was authorized after a superficial inspection. There was no official control during logging to prevent excessive damage to the remaining stand, and no government monitoring after harvesting. For further details, see KAMMEHEIDT *et al.*, 2001.

The legal status of the PFE was introduced by the 1942 forestry act, but it was not until 1965 that forest management was governed by the *Ley Forestal de Suelos y de Aguas* (Forest, Soils and Water Act). During the 1970s, the introduction of a forest concession system represented a significant advance in NFM at 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 (FMU) (CENTENO, 1995); the highest proportion was in the Imataca Forest Reserve (Guyana region; Figure 2). In 1995, the national government planned to increase the area under forest concessions to



Timber transportation after logging in Imataca Forest Reserve, Guyana region.
 Photo E. Vilanova.

Table II.
Status of forest management for wood production in Venezuela (data are given in x 1 000 ha).

Total area - Forest Reserves - Forest Lots - Forest areas under protection	Natural forests			Forest plantations		
	Allocated to concessions/ under licence	With management plans (POMF)	Certified	Total area	With management plans	Certified
≈ 16 000 ha	3 120	1 480	0	863	727	140

Source: adapted from Marn-Dgb, 2001: Boletín estadístico forestal n° 3, año 2000, Caracas, Venezuela; Itto, 2006.

10 million hectares over five years, but the country's adoption of structural adjustment policies and rising criticisms of forest management strategies prevented this from happening. On the contrary, as of mid 2003, only 14 FMU were operating, mainly in forest reserves and in forest parcels in the Guyana region, over a total of 1.48 million hectares (ITTO, 2006). More details are given in Table II.

Sustainable timber production in natural forests

In accordance with the ITTO 2000 Objective, the Venezuelan report to the ITTO states that "...in the year 2001, of the total roundwood volume, 46% came from areas under Forest Management Plans, 37% from Caribbean pine plantations and 17% from annual cutting licenses. Therefore, 83% is obtained from areas managed in a sustainable way" (ITTO, 2002, online). This statement, however, can be challenged, as we show below.

Although 90 % of roundwood production in Venezuela was supplied under annual cutting licenses in 1975, by 1987, natural forest concessions were supplying 40% (CENTENO, 1995). However, this contribution began to decline in 1997. In 1999, the volume of timber extracted from natural forest concessions was even lower than the volume obtained under the annual licensing system (Figure 3).

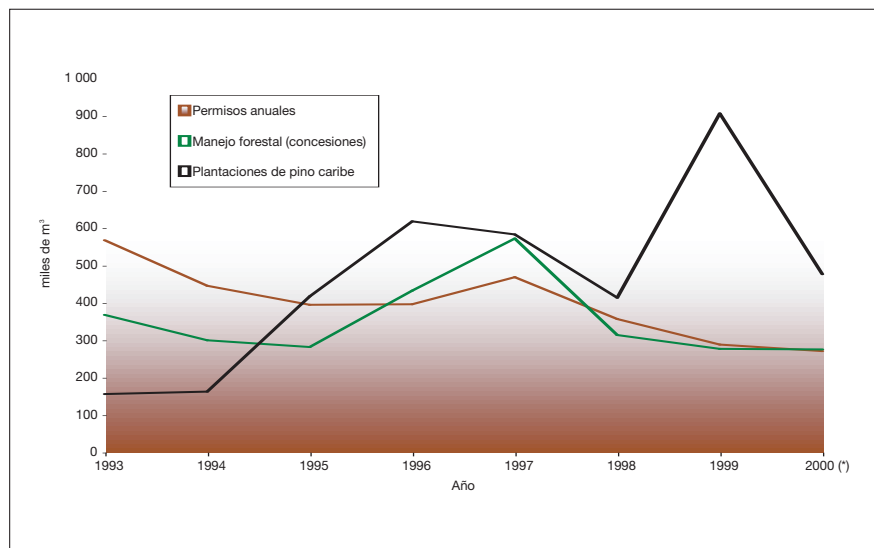


Figure 3.
Roundwood production in Venezuela (10^3 m^3) by source, 1993-2000.
Adapted from MARN, 2001. (*) Estimations.

National legislation establishes few prescriptions to reduce the environmental impacts caused by logging activities. Generally, operations remove almost all commercial trees above the minimum felling diameter (MFD). This practice strongly affects the vertical structure of remaining stands, increases the percentage of damaged trees in the felling zone and within extraction distance, and increases the proportion of areas where the plant layer is entirely removed (landings). A detailed analysis of these impacts in Venezuela's western lowland forests may be found in KAMMESHEIDT *et al.*

(2001). Similarly, it has been found that logging has a significant impact on the composition and structure of avian and small mammal communities (MASON, 1996; OCHOA, SORIANO, 2001).

Furthermore, roads built by forest concessionaires in the Guyana region could reduce forest fragmentation and disturbance if reduced-impact logging (RIL) techniques were adopted. However, the lack of economic incentive has prevented this. It is important to point out that, in a country where the export value of all natural forest products is so low, there are no certified forests.



Traditional logging techniques establish few prescriptions to reduce environmental impacts in Imataca Forest Reserve.
 Photo J. Serrano.



Eucalyptus plantations for pulp production in the western Venezuelan lowlands (Smurfit Cartón de Venezuela).
 Photo E. Vilanova.

Since its beginnings, forest management in Venezuela has been based on the premise that once the forest is exploited, stand growth allows forest mass to recover within 30 years on average. This cutting cycle has therefore been adopted by most logging concessionaires. However, several aspects regarding the recovery process of logged forests are virtually ignored. These include tree growth rate, species regeneration strategies, and the fact that most highly valuable timber species are intermediate shade-tolerant species (nomads), which appear at a late stage in the succession process. Initially, the logged areas are colonized by pioneer species of low commercial value. When logging has a low impact, this may favour the growth of nomad species, but as logging impacts increase, it may take more than 60 years for nomad species to reach the MFD. Consequently, it became evident that logging practices were not compatible with the process of forest recovery, and their commercial value began to decline (TORRES-LEZAMA *et al.*, 1998; KAMMESHEIDT *et al.*, 2001).

Even though silvicultural treatments have been proposed as a strategy for recovering the production potential of logged natural forests, the fact is that they have frequently ignored the importance of pre-harvesting operations and tropical forest dynamics. Generally, such treatments have neither increased system productivity, nor achieved sustainability. On the contrary, their negative effects have aroused strong criticism. Traditional silviculture aimed to create an ecosystem that was “easier to handle”, by reducing biodiversity. This is an out-dated approach in view of the current paradigm of sustainable management. Nonetheless, forest concessionaires in the Guyana region are still asked to carry out enrichment planting for forest conversion in 30% of the logged area.

Analysing the implications of logging in the Brazilian Amazonas, MAGNUSSON *et al.* (1999) point out that poor natural regeneration of

commercial species during the post-harvesting phase has justified this kind of silvicultural treatment. The authors say, however, that an analysis of the economic (yield and productivity) and ecological (mainly modification of biological diversity) implications should be conducted to evaluate the feasibility and benefits of these methods.

Human population growth also results in major pressures on the PFE. Although population density may be considered low in Venezuela, on average, the western lowland area is one of the fastest-growing in this respect. Population growth rates for the area during the 1950s, 1960s and 1970s were 7.0, 5.5 and 4.0%, respectively, well above the national mean (ROJAS-LÓPEZ, 1993). By 2000, the remaining forest fragments accounted for less than a quarter of the forest cover in 1950 and were under severe threat.

Since 1999, the national government has been promoting a social component, as part of the National Forestry Policy to implement a Community Forest Management (CFM) Policy (MARN, 2002). This strategy is mainly based on the following statement: "...the CFM will generate a positive impact on surrounding populations ... which may stimulate the rise of new productive units allowing, in turn, for the improvement of peoples' life conditions" (AZUAJE, 2001). Nevertheless, it seems incorrect to refer to CFM in Venezuela as it is known in Guatemala and Bolivia, where the peasant population has had a strong and long-standing relationship with the forest. In contrast, the rural population in Venezuela's western lowlands is strongly associated with farming activities. Usually the forest is seen as an obstacle to the expansion of the agricultural frontier. In fact, this new policy has rather been linked to a peace strategy and social governance within a protected area with a complex social framework than with the traditional concept of integrated co-management for protected areas (BEVILACQUA *et al.*, 2006).

Furthermore, during the last few years, the lack of opportunities in the area to the north of the Orinoco River has triggered large-scale population migration towards the Guyana region (GFW-VEN, 2002), where socio-economic factors are markedly different. Much of the controversy has centred on the management of the Imataca Forest Reserve (MIRANDA *et al.*, 1998), a fragile area with abundant natural resources that covers over 3.8 million ha in the south-eastern part of the country (BERROTERÁN, 2003). The Zoning Plan, known as "decree 1850" was recently replaced by decree 3110. Although the latter plan has a stronger technical and ecological basis (BERROTERÁN, 2003), it is still too early to assess its contribution to resolving the disputes on how the reserve is being used.

The need for new forestry legislation is widely recognized and formulation is under way, although public discussion has been scanty. It is important to point out that during the last three decades, roles and responsibilities regarding the formulation and implementation of protection and regulation policies and the promotion of production, industry and trade were concentrated within the Ministry of the Environment (MARN). The outcome of this strategy has been questioned because "neither has forest destruction been controlled nor has the country's forestry industry developed" (see MPD, 2002). In 1999, a presidential decree partially revised the Central Administration Law, which now separates the production, industry and trade functions and assigns them to the new Ministry of Production and Trade (MPC) – for further comments, see GFW-VEN (2002). The separation of functions took root more deeply in 2002 when the Ministry of Agriculture and Lands (MAT) was created (MPD, 2002). In spite of these new instruments, conflicting ministerial interests and poor institutional coordination have hampered forest conservation and development of the forestry sector.



Plant species diversity and canopy trees in Venezuela's western lowland forests (Caparo Forest Reserve).
Photo E. Vilanova.



Enrichment planting as a silvicultural treatment within a management concession unit at Imataca Forest Reserve.
Photo E. Vilanova.



Stand of teak in a plantation in the western Venezuelan lowlands.
 Photo E. Vilanova.

Regarding international initiatives, Venezuela, like most South American countries, is a signatory to several potentially beneficial treaties and agreements. However, the prospects are uncertain. For instance, the ambiguous position of a country which is a member of the Organization of Petroleum Exporting Countries (OPEC) and also has a large surface area for forest plantations casts doubt on potential benefits to be derived through the Kyoto Protocol's Clean Development Mechanism (CDM), which was ratified by the Venezuelan government in May 2005. Similarly, despite its high biological diversity, Venezuela has scarcely benefited from the Convention on Biological Diversity (CBD), in comparison to other Latin American countries like Brazil and Costa Rica. Under the Treaty for Amazonian Cooperation (TCA) signed in 1978, Venezuela has participated in the Initiative for Sustainable Forest Management Criteria and Indicators, also known as the Tarapoto Process, but progress has been very slow.

Sustainable use of non-timber forest products

As the national government is promoting CFM, introducing sustainable use of non timber forest products (NTFP) along with a gender-based approach might increase the feasibility of this management option. Although many people living in or near Venezuelan forests depend on NTFP for their livelihoods and well-being, available statistics for these products are less reliable than for timber products. Palm hearts extracted from the “*palma manaca*” (*Euterpe oleracea* Mart) stand out among the NTFP. This highly prized food product is mainly harvested in the swamp forests of the Orinoco Delta, where more than 160 000 ha have been granted in long-term concessions since the 1980s. National production is reported as 1 900 000 units, of which approximately 90% is exported (MARN, 2001).

Despite the difficulties encountered by the Orinoco Delta concessionaires, it seems feasible to harvest palm hearts sustainably thanks

to clonal regeneration. Nevertheless, detailed research is needed on the subject. Specifically, it is essential to be aware of the environmental impacts of *palma manaca* harvesting (soil, vegetation, hydrology) and to understand the dynamics of species populations. Similarly, proper integration of the Warao people, an indigenous group living in the region, is required in order to improve their well-being and contribute to regional development. The possible effects of mining and oil exploitation also need to be taken into consideration.

Similarly, planning for sustainable use of “*mamure*” lianas (*Heteropsis spruceana* Schott) is urgently needed, because indiscriminate extraction of aerial roots to meet local, national and international demand for furniture manufacture is already exhausting the resource of this Araceae species in the state of Amazonas.

Other NTFPs of importance for local communities include the “*chiquichiqui*” palm (*Leopoldinia piassaba* Wallace), whose fibre is used as a raw material for a wide variety of industrial and craft products. Other plant species provide fibres, oils, gums, fuelwood and charcoal. For further details, see GFW-VEN (2002).

Sustainable timber production in forest plantations

Large-scale tree plantations were initiated by the national public sector in the late 1960s. By 2001, the total accumulated area of forest plantations was reported as 863 000 ha (ITTO, 2006). Caribbean pine plantations account for the largest share (533 018 ha). See Table II for more information.

In the eastern Venezuelan lowlands, one of the most impressive achievements has concerned Caribbean pine plantations in seasonal savannas. In three decades, considerable advances have been made in techniques for nursery plant

production and tree plantations. However, despite the fact that these techniques are supposed to prepare plants to allow them to survive in poor soils with high water stress, juvenile and adult mortality appears to be high (CEDEÑO *et al.*, 2001).

Caribbean pine plantations can apparently resist severe but short periods of physiological stress, responding with a change in productivity. Longer stress periods, however, either alone or in combination with other factors, may lead to system collapse. Signs of system instability (“foxtailing” and reproductive asynchrony in trees) have thus been observed in the early growth stages, as in other world regions. Nevertheless, the most severe sign of system instability in these extensive monocultures has been what was initially called “dieback”. Tree mortality has occurred in stands of different

ages, in conditions of high and low density, and in all operational soil classes. Microclimatic characteristics, soil quality and probably the El Niño Southern Oscillation all make the system highly vulnerable in terms of susceptibility to pathogen attacks (CEDEÑO *et al.*, 2001; TORRES-LEZAMA *et al.*, 2001a and b).

The problem has persisted and is probably worsening in the pine plantations managed by CVG-Proforca, a subsidiary forestry company of the *Corporación Venezolana de Guayana* (CVG), the second largest public corporation in Venezuela after the oil company *Petróleos de Venezuela S.A.* (PDVSA). However, the international company *Terranova de Venezuela* (TDV) has made considerable efforts towards sustainable management of its plantations, and it has recently (2003) obtained certification of 139,650 ha from the

SmartWood programme, under the Forest Stewardship Council (FSC) (www.smartwood.org/reports/pdfs/terranova.pdf).

This “green” seal of approval is seen as a strategy to improve product marketing and, hopefully, will contribute to sustainable management of these important forest plantations. However, several socio-economic problems still need to be resolved within the sphere of influence of these Caribbean pine plantations. Many communities are characterized by high levels of unemployment, poor housing, inadequate public services and restricted road access (see: www.smartwood.org/reports/pdfs/terranova.pdf).

Caribbean pine mortality may considerably reduce profit levels as well as the quantity and quality of raw material supplies, which translates into market losses. None-



One of many forest uses for indigenous communities in the Guyana region.
Photo A. Torres Lezama.

theless, the contribution of these plantations to national roundwood production has been increasing since 1994. Initially established to supply a large pulp factory which has still not been built, the national share of Caribbean pine plantations began to increase, reaching 61.72% in 1999 (Figure 3).

The paper industry obtains raw materials mainly from imports and recycling. Available statistics have revealed a general decline since 1997, especially in paper, card and cardboards products, although these still represent the largest share in the sector (Table III). This trend, which affects profitability, investment opportunities and job creation, has been associated with national market reduction (MPD, 2002). Wood pulp and recyclable fibre production fluctuated widely during the period from 1997 to 2005.

Teak (*Tectona grandis* L. f.) monocultures in deforested areas deserve a separate mention. In the western plains, this introduced species has adapted very well and is highly productive in well drained soils with less than 30% clay content (KAMMESHEIDT *et al.*, 2001). Harvesting the plantations established during the 1970s and 1980s in the Ticoporo area has had a positive economic impact in the region (MPD, 2002). In short, with adequate planning and good management, it is possible to produce teak timber in a sustainable way in a substantial area of the western plains.

On the other hand, Venezuela has a considerable amount of land with potential for the establishment of tree plantations. With proper planning and management, stand yields could be distinctly higher than those reported for the Caribbean pine plantations. In 1992, the national government issued a decree to reserve 10% of the country's territory (9.3 million ha) for the establishment of forest plantations. However, almost a decade later, the acting government approved the controversial *Ley de Tierras y Desarrollo Agrario* (Lands and Agrarian Development Act), which restricts forest plantations to the poorer land categories. The areas destined for commercial forest plantations will therefore probably decline.

Concluding remarks

Venezuela has a large forest resource base and major potential for the development of forest plantations. However, serious efforts are needed to update current information on the state of forests and forest types, to address the existing high rates of deforestation, and to improve the poor planning and management of natural forests, which has caused forest management failure in the western plains and could spread to the Guyana region. Recognising the vulnerability of Caribbean pine ecosystems is crucial, and proper

measurements should be taken. Moreover, more attention should be given to sustainable development through forestry, national and international cooperation on forest issues, global and inter-sectoral approaches, legal and institutional reforms and capacity building.

Under certain circumstances, the participation of local communities may help to achieve sustainable forest management. However, community forest management must be developed in a professional and responsible manner, in order to avoid the destruction of forest resources.

In order to maximise the benefits, NTFP management and forest environmental services should be considered. With the formulation of the "National Strategy for Biological Diversity", the country has begun to evaluate and measure the economic importance of natural forest biodiversity. Similarly, some projects on the valuation of watershed protection services and carbon sequestration are under way.

Finally, we propose a more in-depth review of the way forest resources have been managed in Venezuela than the outline presented here. This should lead, amongst other goals, to a strengthened forest sector, the development of new policies on forest concessions, more effective integration of local communities and lower impacts on natural forests.

Table III.

National production of wood pulp, card, cardboards and recyclable fibres (in tonnes), 1997-2005.

Description	1997	1998	1999	2000	2001	2002	2003	2004	2005
Paper, card and cardboard	707 743	637 196	547 838	433 492	426 239	238 109	302 100	439 465	404 778
Wood pulp	175 854	136 815	127 906	172 719	176 359	92 106	95 980	108 263	107 860
Recyclable fibres	263 752	280 275	214 625	241 589	220 456	214 269	149 720	210 938	219 578
Total	1 147 349	1 054 286	895 369	847 800	832 054	544 484	547 800	758 666	732 216

Source: Apropaca, 2007 (<http://www.apropaca.com.ve>)

References

- AGUILERA M., AZÓCAR A., GONZÁLEZ-JIMÉNEZ E. (ed.), 2003. Biodiversidad en Venezuela. Caracas, Venezuela, Fundación Polar, 2 vol., 1071 p.
- AZUAJE J. I., 2001. Manejo forestal en Venezuela. Informe de avance del proyecto de FAO información y análisis para el manejo forestal sostenible: integrando esfuerzos nacionales e internacionales en 13 países tropicales en América Latina. (GCP/RLA/133/EC). Santiago, Chile. Available in <http://www.rlc.fao.org/proyecto/rla133ec/MF-pdf/MF%20Ven.PDF>. (20 April 2006)
- BERROTERÁN J. L. (ed.), 2003. Reserva forestal Imataca: ecología y bases técnicas para el ordenamiento territorial. Caracas, Ministerio del Ambiente y los Recursos Naturales-Universidad Central de Venezuela, 207 p.
- BEVILACQUA M., CÁRDENAS L., MEDINA D., 2006. Las áreas protegidas en Venezuela: diagnóstico de su condición 1993-2004. Caracas, Venezuela, Fundación Empresas Polar, 163 p.
- CEDEÑO L., CARRERO C., FRANCO W., TORRES-LEZAMA A., 2001. *Sphaeropsis sapinea* asociado con quema del cogollo, muerte regresiva y cáncer en troncos, ramas y raíces del pino caribe en Venezuela. *Interciencia*, 26 (5): 210-215.
- CENTENO J.C., 1995. Estrategia para el desarrollo forestal en Venezuela. Caracas, Venezuela, Fondo Nacional de Investigación Forestal, 83 p.
- DELAHAYE O., 2001. Políticas de tierras de Venezuela en el siglo XX. Caracas, Venezuela, Fondo Editorial Tropykos, 222 p.
- FAO, 2004. Socio-economic trends and outlook in Latin America: implications for the forestry sector to 2020. Available in: <http://www.fao.org/DOCREP/006/J2459E/j2459e01.htm>
- GFW-VEN, 2002. The state of Venezuela's forest: a case study of the Guayana region. Caracas, Global Forest Watch, Venezuelan Chapter-WRI-Fundación Polar, 132 p.
- HARCOURT C. S., SAYER J. A. (ed.), 1996. The conservation atlas of tropical forest: The Americas. New York, United States of America, Simon & Schuster, 335 p.
- ITTO, 2002. Reseña anual y evaluación de la situación mundial de las maderas. Documento GI-7/02, Venezuelan Report. International Tropical Timber Organization. Yokohama, Japan. Available in http://www.itto.or.jp/live/Live_Server/366/brochure_measuringup_s.pdf
- ITTO, 2006. Status of tropical forest management 2005. ITTO Technical Series, n° 24. International Tropical Timber Organization, Yokohama, Japan, 305 p.
- KAMMESHEIDT L., TORRES-LEZAMA A., FRANCO W., PLONCZAK M., 2001. History of logging and silvicultural treatments in the western Venezuela plain forests and the prospect for sustainable forest management. *Forest Ecology and Management*, 148 (1): 1-20.
- MAGNUSSON W. E., DE LIMA O. P., QUINTILIANO REIS F., HIGUCHI N., RAMOS J.F., 1999. Logging activity and tree regeneration in an Amazonian Forest. *Forest Ecology and Management*, 113 (1):67-74.
- MARN, 2001. Boletín de estadístico forestal n° 3 - año 2000. Caracas, Venezuela, Ministerio del Ambiente y Recursos Naturales, Dirección General del Recurso Forestal.
- MARN, 2002. Política nacional de bosques. Caracas, Venezuela, Ministerio del Ambiente y de los Recursos Naturales, Dirección General Sectorial del Recurso Forestal, 45 p.
- MASON D. J., 1996. Responses of Venezuelan understory birds to selective logging, enrichment strips and vine cutting. *Biotropica*, 28 :296-309.
- MIRANDA M., BLANCO-URIBE A., HERNÁNDEZ L., OCHOA J., YERENA E., 1998. No todo lo que brilla es oro: hacia un nuevo equilibrio entre conservación y desarrollo en las últimas fronteras forestales de Venezuela. WRI, Washington DC, United States of America, 52 p.
- MPD, 2002. Plan nacional de desarrollo forestal (propuesta). Caracas, Ministerio de Planificación y Desarrollo, Venezuela, 139 p.
- OCHOA J., SORIANO P., 2001. The effects of logging on nonvolant small mammal communities in neotropical rainforests. *In*: Fimbel R., Grajal A., Robinson J. (ed.). *The Cutting Edge: Conserving wildlife in logged tropical forests*. New York, United States of America, Columbia University Press.
- ROJAS-LÓPEZ J., 1993. La colonización agraria de las reservas forestales: ¿Un proceso sin solución? Cuadernos Geográficos n° 10. Mérida, Venezuela, Universidad de Los Andes, 110 p.
- TORRES-LEZAMA A., RAMÍREZ H., BALDOCEDA R., 1998. Predicción de la respuesta de un bosque tropical venezolano a diferentes estrategias de manejo. *In*: Memorias del Simposio Internacional Posibilidades de Manejo Forestal Sostenible en América Tropical, Santa Cruz de la Sierra, Bolivia, 15-20 julio 1997. Santa Cruz, Bolivia, BOLFOR-CIFOR-IUFRO, 234-240.
- TORRES-LEZAMA A., DÍAZ M., RAMÍREZ H., FRANCO W., LUGO L., CEDEÑO L., CARRERO C., 2001a. Informe final del estudio diagnóstico y presentación de posible soluciones al problema de mortalidad en las plantaciones de pino caribe de la empresa CVG-PROFORCA. Universidad de Los Andes, Mérida, Venezuela, 232 p.
- TORRES-LEZAMA A., DÍAZ M., RAMÍREZ H., ANDRESSEN R., LUGO L., CARRERO C., CEDEÑO L., 2001b. Natural hazards assessment and management in Caribbean pine plantations of eastern Venezuela. *In*: The Economics of Natural Hazards in Forestry, Solsona, Spain, 7-10 June 2001. Padua University Press, CFTC-EFI-IUFRO, 21-30.
- VEILLON J. P., 1976. Las deforestaciones en los llanos occidentales de Venezuela desde 1950 hasta 1975. *In*: Conservación de los Bosques Húmedos de Venezuela. Hamilton L.S., Steyermark J., Veillon J.P., Mondolfi E. (ed.). Caracas, Venezuela, Sierra Club, 97-110.
- WRI, 2001. World resources report. Washington D.C., United States of America, World Resource Institute, 389 p.