

TEMPORAL AND SPATIAL DYNAMICS IN THE EXTRACTION OF NON-TIMBER FOREST PRODUCTS IN THE NORTHERN BOLIVIAN AMAZON

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ABSTRACT

For more than a century, northern Bolivia has had a tradition of commercial forest exploitation. For several decades into the twentieth century, the extraction of rubber and Brazil nuts was combined with subsistence agriculture, resulting in an agro-extractive cycle that fostered a sedentary lifestyle of forest dwellers. The extraction of rubber and Brazil nuts used to be organized in a debt-peonage system, often leaving extractivists in debt to the patron. The decline of the Bolivian rubber market during the 1980s induced the breakdown of the agro-extractive cycle. Most people left the patron-controlled extraction areas (*barracas*), and either established themselves as farmers in independent communities close to urban areas or migrated to the cities where the processing of forest products had increased job opportunities. About half the Brazil nut collectors are now seasonal migrants, mainly from the cities. Depending on access to land, forest resources, and markets, extraction-based income can contribute to more than 50% of the overall household income, especially in the more remote forest settlements. Some processing plants gain direct access to the Brazil nut resource base through vertical integration, thereby increasing their control of the production process. These large enterprises partly take over the role of the former patrons (e.g. in making advance payments to the Brazil nut collectors). The increasing demand for Brazil nuts and the increased in-country processing in Bolivia has benefited all participants in the production process, including the collectors. Especially the collectors from independent communities manage to get a higher price for the nuts they collect. Even so, an unequal exchange continues to be characteristic of many non-timber-forest-products-based (NTFP-based) production systems. In addition, more recent extractive activities (e.g. logging and palm-heart extraction) are threatened by depletion of the resource base. None of the extractive activities thus fulfills all the criteria of sustainable development.

1. INTRODUCTION

The extraction of non-timber forest products (NTFPs) has been advocated as a land-use practice that

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integrates the conservation of the rain forest and the economic development of the forest-dependent people (see, e.g., Nepstad and Schwartzman, 1992; Allegretti, 1990; Plotkin and Famolare, 1992). Based on the concept of sustainable development as defined by Barbier (1987), NTFP extraction is said to be economically viable, ecologically sound, and socially acceptable.

The potential economic value of NTFPs has been demonstrated by the benchmark study of Peters *et al.* (1989). An income comparison for one hectare of forest near Iquitos (Peru) between three land-use types (i.e. logging, cattle ranching, and NTFP extraction) revealed that the net present value of NTFP extraction is highest. At that time, through the IUCN-NI study of de Beer and Dermott (updated in 1997), the Netherlands participated in the international debate on the economic value of NTFPs in South-East Asia. These and other studies emphasized not only the subsistence value of these products but also their monetary value (see, e.g., Anderson, 1990; Balick and Mendelsohn, 1992). A second study, initiated in the early nineties by IUCN-NL and executed by the Prince Bernhard Centre for International Nature Conservation of the Utrecht University, showed the dynamics in the export value of some NTFPs for several Amazonian economies (Broekhoven, 1996). The study revealed that, although in several cases the economic value of these products is substantial, the assumed sustainability of these exploitation systems is often based on wishful thinking, rather than a thorough analysis of all components of sustainability.

The second IUCN study launched several new initiatives in the Netherlands:

- In 1992, Utrecht University, in collaboration with the Universidad Tecnica del Beni and the Instituto para el Hombre Agricultura y Ecologia, started a multi-disciplinary research, training, and extension programme on the sustainable exploitation of (non-timber) forest products in northern Bolivia: PROMAB.
- In 1996, the CIFOR-BMZ Project on 'Contributions of non-timber products to socio-economic development' commended its collaboration with the socio-economic component of PROMAB. The CIFOR-BMZ Project comprises the Universities of Freiburg and Hamburg, Germany, and partner institutions in Bolivia and Zimbabwe;
- The Tropenbos Foundation published a research strategy on this topic (Ros-Tonen *et al.*, 1995), incorporating NTFP research in their ongoing research (see, e.g., van Valkenburg, 1997).

In this paper, we shall summarize some results of the socio-economic research derived from the collaboration between PROMAB and CIFOR. The content of this paper is based mainly on the following publications by Assies (1997), Stoian (1998), and Stoian and Henkemans (1998).

2. NORTHERN BOLIVIA

Northern Bolivia is still blessed with large tracts of relatively undisturbed rain forest. The study area encompasses the Department of Pando, the Province of Vaca Diez (Beni Department), and the northernmost part of the Province of Iturrealde (La Paz Department). On an area of about 100,000 km², the population in 1997 was estimated at 140,000 people, 70% of whom reside in urban areas while the remainder inhabit the rural areas (Stoian and Henkemans, 1998). More than 95% of the original forest cover is still intact. Between 1986 and 1990, the mean annual deforestation rate was 0.15 % (DHV, 1993a). This contrasts sharply with deforestation in adjacent areas in Brasilia: Acre (0.58%) and Rondonia (2.09%). The low population density in the rural areas is a result of a low level of social services (education, health), poor infrastructure, and the lack of employment opportunities. In the light of low soil fertility and poor agricultural tradition, slash-and-burn agriculture suffers from low productivity. Agrarian underdevelopment has its roots in the prohibition of subsistence agriculture during the boom years of rubber production. Nowadays, agricultural development is impeded by

insecure land rights and the lack of access to credits and technical assistance.

3. DETERMINANTS FOR SUSTAINED EXTRACTION OF NON-TIMBER FOREST PRODUCTS

From a socio-economic perspective, the sustainable exploitation of NTFPs is determined by a complex set of interacting and interrelated factors (Ros-Tonen *et al.*, 1995). Chief among them is probably the economic incentive for those involved in the extraction, processing, and marketing of NTFPs and in forest management. For the collectors of NTFPs, the incomes generated from this activity and its competitiveness with other economic activities are the key factors determining their participation. For the entities involved in processing and marketing, the determinants of their continued involvement in the exploitation of NTFPs are the availability and costs of labour, credits, technology, access to resources and markets, and, above all, the internal rate of return as the main determinant. Some of these factors are spatially dependent, or, in other words, they vary from place to place.

These considerations have led to the following aim of the socio-economic research conducted jointly by PROMAB and CIFOR:

To determine the underlying factors of spatial and temporal dynamics in forest resources in northern Bolivia.

Research is divided into three interrelated studies operating at various levels:

- The *analysis of livelihood strategies of the people living in the forest* reveals the scope of their economic activities and their motivation to participate in them. Their situation is highly dynamic as new job opportunities are perceived outside the forest and as others enter the forest (i.e. the increasing timber logging, and agriculture and agroforestry activities that are generating more prosperity because of the improving infrastructure and a change in the tenure systems);
- The *variation and dynamics in NTFP-based economies at the rural-urban interface*. This study will determine the dependence of various types of rural and peri-urban households on NTFP-based income, the underlying modes of NTFP commercialization, as well as the distribution of benefits along the marketing chain of Brazil nuts and palm hearts;
- The *spatial and temporal importance of forest products in the regional economy*. This will result in an economic and socio-political perspective for the forest industry and consequences for the use of natural resources. It is revealing the partly contrasting valuation of forest resources at the local, national, and global levels, and the political mechanisms that are steering land-use planning.

4. TEMPORAL DYNAMICS IN FOREST PRODUCT EXTRACTION IN NORTHERN BOLIVIA

In northern Bolivia, the commercial extraction of NTFPs commenced in the first half of the nineteenth century, with the exploitation of Peruvian bark (*quina* in Spanish). During the 1860s, extractivism shifted towards rubber, but it was not until 1880 that its export began on a large scale (Ormachea and Fernández, 1989). Between 1900 and 1913, Bolivian rubber production reached its boom years. The exploitation of rubber was organized in estates, locally known as *barracas*. The rubber tappers worked and lived in a debt-peonage system: they were advanced subsistence goods and basic necessities in return for the future delivery of rubber. Family-based agriculture was discouraged in the *barracas* so as not to divert the work force from the main activity and to enforce the dependency relationship between the estate owners and their workers (Assies, 1997). In some *barracas*, a common agricultural plot was worked by some of the dependants under the control of the patron. For their labour, however, they were reimbursed with only a small share of the harvest. From 1913 onwards, the production slowly

decreased because of competition from rubber plantations established in South-East Asia and the introduction of synthetic substitutes. When the boom had turned into a bust, the *barraca* economy had to be modified considerably. Many patrons permitted subsistence agriculture on their estates, while they turned towards the utilization of Brazil nuts to compensate for the income losses. Other patrons, especially the most indebted ones, had to abandon their *barraca*. The first independent communities founded by previously dependent rubber tappers thus came into existence.

Commencing in the late 1920s and continuing up to the present, the commercial extraction of Brazil nuts is still playing an important role, both in the *barracas* and in independent communities. During the 1990s, Brazil nuts became the chief forest product in northern Bolivia (see Figures 1 and 2). This increase in value is due to (López, 1996):

- Increased in-country processing;
- An increase in unit price;
- Increased production.

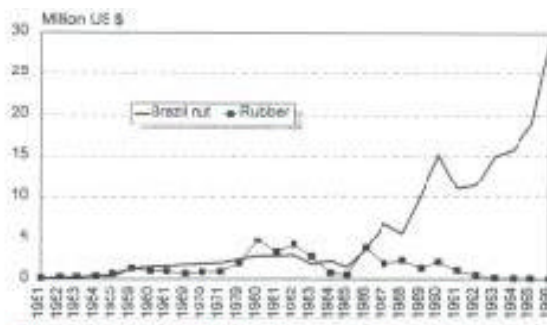


Figure 1 Value of Brazil nut and rubber exports from Bolivia between 1951-1996 (Stoian and Henkemans, 1998)

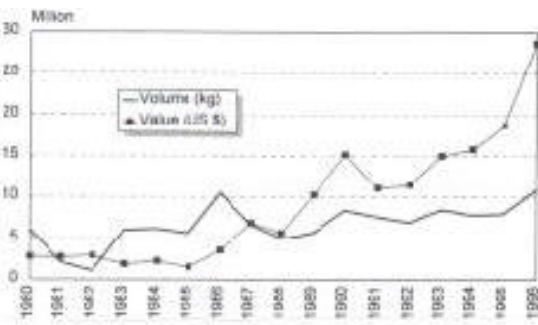


Figure 2 Volume and value of Brazil nut exports from Bolivia between 1979-1996 (Stoian and Henkemans, 1998)

Bolivia partly took over the export share of Brazil, where the introduction of minimum wages had rendered in-country processing less competitive, given that wages in the Brazilian processing plants are 30% higher than those paid in Bolivia (Assies, 1997). Similarly, prices per unit rose because of an impressive increase in the export of shelled nuts. It increased from 12% in 1985, via 58%, to 99% in 1996 (Broekhoven, 1996; Stoian, 1998). In the same period, the number of processing plants (*beneficiadoras*) in Riberalta increased from one to seventeen, which provide employment to some 5,500 (mainly female) workers (Coemans and Medina, 1997).

For a few decades, the extraction of rubber and Brazil nuts, in combination with small-scale agriculture, had provided a set of complementary economic activities that enabled people to make a living in the forest throughout the year. In this agro-extractive cycle (Assies, 1997), forest-dwelling people allocated more than 50% of their working hours to the extraction of forest products (see Figure 3).

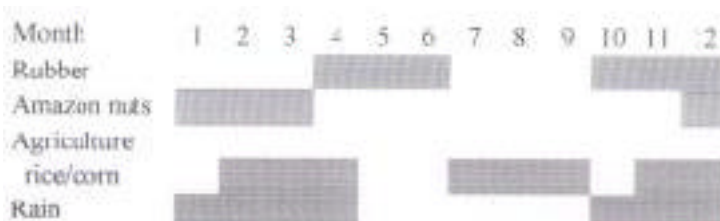


Figure 3 Agro-extractive cycle northern Bolivia

During the late 1980s, rubber production in northern Bolivia declined and finally reached a standstill in the early 1990s (Stoian, 1998). This had severe repercussions for the rural people, who had to replace their rubber-based income with income derived from other forest products. Mainly for this reason, the exploitation of palm hearts and timber has increased substantially in the last few years. For example, the value of palm hearts exported from northern Bolivia rose from US\$ 2 million in 1993 to US\$ 5.7 in 1996 (Stoian, 1998).

5. SPATIAL VARIATION IN FOREST-PRODUCT EXTRACTION

5.1 Settlement differentiation and related migration patterns

With the collapse of the Bolivian rubber market and consequently the breakdown of the agro-extractive cycle, many former rubber-tapper families emigrated from the *barracas*, especially from the more remote ones. Most of them migrated to one of the three urban centres in search of better school and health facilities and employment in one of the processing plants or in the tertiary sector. Others opted for an independent community to make their living from (commercial) agriculture and extractive activities on their own plots, often supplemented by income derived from wage labour. Varying trade-offs between these three main economic activities in rural areas are taken as a base for a settlement typology suggested by Stoian and Henkemans (1998). Their typology distinguishes four types of *barracas* and six types of independent communities, some features of which are laid down in Table 1.

Table 1 illustrates the pattern of movements that occurred between *barracas* and independent communities in the wake of the economic transformation induced by Bolivia's rubber crisis. During the late 1980s and early 1990s, the *barracas* suffered from a marked-out emigration, while independent communities on the average experienced substantial immigration.

An important aspect of the above-mentioned transformation process is the decline of the patrons' central position as the main providers of Brazil nuts. The owners of the processing plants gained in status by buying up patron-owned *barracas* in an effort to gain vertical integration (Assies, 1997). Because of the massive emigration from the *barracas*, both patron-owned and enterprise-run *barracas* nowadays depend heavily on a labour force that seasonally migrates to the production areas. Out of a total of about 10,000 Brazil nut collectors, some 5,000 are recruited from urban areas; the other 5,000 stem from rural areas, 1,000 of whom leave for the *barracas* after having secured the Brazil nuts from their own forest lands (Stoian, 1998; Stoian and Henkemans, 1998).

The boom in the Brazil nut industry generated new job opportunities in the cities, especially in Riberalta. During the collection season, most processing plants close down, and many worker families take part in the Brazil nut collection.

Table 1 A few characteristics of rural settlements in northern Bolivia. Data are a result of a sample of 173 settlements out of the approximately 700 settlements in the study area. The sample is regarded as representative for *barracas* and independent communities in northern Bolivia. Settlements poorly accessible by road or river, however, may be slightly underrepresented in the sample. Source: Village-level Survey 1997 (Stoian and Henkemans, 1998)

		Demographic		Spatial arrangements		Brazil nut economy			Agricul.
	(N)	# families in 1997 (avg.)	# former rubber tapping families (avg.)	distance to next urban center (hours)	settlements accessible by road (%)	# Brazil nut crates per settlement (avg.)	# Brazil nut crates per collector family (avg.)	Avg. price per crate (96/97) in Bs = 0.2 US\$	hectares cultivated land per family (avg.)
Barracas									
- Enterprise/owned	14	6.2	65.2	15.6	14.3	9807	110.9	19.4	1.04
- Large private	22	3.9	30.2	11.9	36.4	5950	177.2	19.8	1.34
- Small private	22	3	8.8	9.4	31.8	878	105.7	20.8	1.69
- In transition	15	10.9	40.6	6.8	73.3	4660	169.7	22.9	1.31
Independent communities									
- Peri-urban	7	27.9	4.7	0.3	100	1171	42.1	35.6	1.63
- Agrarian	19	19.9	4.9	0.6	94.7	98	4.7	33.3	2.27
- Agro-extractive	22	29.6	13.1	0.7	100	1174	36.1	33.8	2.11
- Extractive	26	28.2	21.5	2.8	80.8	5074	139	36	1.97
- Indigenous	8	27.9	7.5	11.2	37.5	2669	87.5	35.6	1.44
- Rural sub-centers ²	8	145.9	90.8	2.7	100	22250	150.9	32.1	2.19

5.2 Spatially-dependent production and income

Fueled by an ongoing conversion of *barracas* into independent communities, the latter's share in the Brazil nut production of northern Bolivia has increased in recent years. It was estimated at 20% to 32% in 1992 (DHV, 1993b), but the highly productive extractive communities along the main road Puerto Rico-Cobjija were not taken into account. Data based on a more comprehensive village-level survey conducted in 1997 suggest that today's shares of *barracas* and independent communities are 60% and 40%, respectively (Stoian, 1998).

2 The rural sub-centres emerged from the first large *barracas* established by rubber barons in areas with abundant rubber trees and located at intersections of important roads or rivers. Nowadays, they are the base of a municipality enabling them to tap from funds of the *Participación Popular*, the decentralization process that is going on in Bolivia. These centers have access to infrastructure like secondary schools, health centers, communication facilities, drinking water and electricity. A large number of families immigrated into these centers facilitated by the availability of lots of a considerable size for a lower price than those in the urban centers.

Remarkable is the higher price paid for Brazil nuts to independent communities; it is an average of 1.7 times higher than that paid to the *barracas* (see Table 1). This is mainly due to the fact that the urban-based processing plants pay the same price for the raw material to independent collectors, patrons, or intermediaries. As a result, an independent collector receives not only the minimum price, which, according to the labour inspectorate, has to be paid to a *barraca*, but also the surplus of a patron. Differences in transport distance play only a marginal role in the stipulation of raw material prices. Among the different *barraca* types, however, there is a price differentiation: in enterprise-run *barracas* and large private *barracas*, prices paid to the collectors usually do not exceed the minimum price. In contrast, patrons of small private *barracas* and *barracas* in transition have to top up this price by one to three *bolivianos* per box, as their production areas are situated closer to independent communities, which means that they face more competition. The Brazil-nut-based income earned by an average collector in *barracas* and independent communities varies only slightly, as the latter collect fewer nuts at a higher price than the former. In the season 1996/97, for instance, an average collector in a *barraca* earned about US\$ 540 from the collection of 139 boxes, whereas his counterpart in an independent community earned US\$ 520 with the collection of only 79 boxes (Stoian, 1998). The increasingly stronger position of independent collectors reflects a process called the 'democratization of the Brazil nut trade' (DHV, 1993a).

5.3 Exploitation moving through the forest

In contrast to the Brazil nut harvest, palm heart extraction takes place during the dry season, that is to say the period when rubber used to be tapped. Thus, exploitation of the Asai palm (*Euterpe precatoria*) could potentially fill the gap left in the agro-extractive cycle by the abandonment of rubber tapping. The single-stemmed nature of the palm, however, implies the plant's death upon removal of the palm heart. As it takes the palm several decades (if not more than a century) to mature (cf. Peña, 1996; PROMAB, 1998), and thus to produce a palm heart of exploitable size, raw material stocks are depleted within three to four years in a given place (Stoian, 1998). After the harvest, the raw material has to be transported to and processed in a palm heart factory within 72 hours to avoid perishing. This fact and the over-exploitation of palm hearts in the surroundings of the urban centres force the factories to move further upstream to be within reach of unexploited stocks (Stoian, 1998). The palm heart industry of northern Bolivia has about 620 permanent employees (Hofmann, 1997) and provides temporary employment to an estimated 2,300 collectors (Stoian and Hofmann, in prep.).

In addition to the exploitation of palm hearts, many *barraca*-owners have permitted the extraction of timber from their forest lands. As they lack the necessary machinery, they allow sawmills to conduct the logging operations. The provision of the raw material, however, is reimbursed only marginally. Unlike the palm heart factories, most of the sawmills are urban-based because of the better infrastructure available in towns. Spatial variations in the procurement of the raw material, however, resemble those of palm heart extraction, in that each year more remote settlements are affected by logging because of the depletion of commercially valuable species in the vicinity of urban centres (Stoian, 1998).

6. CONCLUSIONS

The extraction of non-timber forest products is an essential part of livelihood systems in the northern Bolivian Amazon. The commercial exploitation of rubber and Brazil nuts used to be an integral part of an agro-extractive cycle within which their extraction was combined with (subsistence) agriculture. The recent collapse of the Bolivian rubber market thus called for substantial modifications in livelihood strategies. In rural areas, rubber exploitation as a dry-season activity has mainly been replaced by the

extraction of palm hearts and timber, while the importance of agriculture has increased. In urban areas, to which a large number of former rubber tappers migrated with their families, the thriving Brazil nut industry and an increasing tertiary sector provide new employment opportunities. The boom of the Brazil nut trade further benefits the collectors, an increasing number of whom receive higher prices as independent collectors. Nevertheless, more than half of the Brazil nuts continue to be collected in the *barracas*, which are controlled by patrons or enterprises. The distribution of benefits is thus skewed towards those who have larger production units at their disposal. Nevertheless, all actors along the Bolivian marketing chain benefit from increased in-country processing and, consequently, bringing economic value close to the sites of production. The processing plants play a vital role in a vivid Brazil nut market, whose benefits finally trickle down to both independent and dependent collectors.

Despite all doubts that remain about social-equity issues in the Bolivian NTFP trade, more attention needs to be given to the ecological soundness and, hence, to the economic viability of palm heart and timber extraction. In contrast to rubber tapping, these extractive activities are hardly practised in a sustainable fashion. Although the loss of rubber-based incomes could be partly compensated for by the exploitation of palm hearts and timber, the continuance of this endeavor is severely threatened by the rapid depletion of the resource bases. For this reason, new paths have to be explored that reconcile the economic needs of the rural and peri-urban population with the ecological requirements of sound forest management.

Institutional support to rural households is mostly needed for land rights, formal and non-formal education, improvement of local infrastructure, and diversification of agricultural practices. In urban and peri-urban areas, upgrading of skills of the previously mainly rural population has to be accompanied by a diversification of the urban economy, which depends both on initiatives of political institutions at various levels and on investments by the private sector. The utilization and marketing of non-timber forest products will continue to play a vital role in the development of the regional economy, but has to be seen and promoted in the wider context of rural and urban development.

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Achievements

- Study on export values of NTFP.
- Inventory of (spatial) mechanisms of resource extraction on Northern Bolivia.

Challenges and Problems; Information Needs

- High dynamism of population movements and utilisation of NTFP prevents sustainable management of NTFP.
- Isolation and poor level of services.
- Unequal access to natural resources.

Points for Future Research

- Mechanisms for participation of forest-dependent people in NTFP extraction and management.
- Population ecology and management of NTFP.

Conclusions

- Sustainability of NTFP extraction is an assumption rather than an established fact.
- The forest is an open economic system.
- External factors push forest and NTFP exploitation.