SHIFTS IN FOREST PRODUCT EXTRACTION: THE POST-RUBBER ERA IN THE BOLIVIAN AMAZON

DIETMAR STOIAN

Institute of Forest Policy, Markets and Marketing Section, University of Freiburg, Bertoldstr. 17, 79085 Freiburg, Germany. stoian@uni-freiburg.de

ABSTRACT

Commercial exploitation of non-timber forest products has been playing a major role in the northern Bolivian Amazon for more than a century. Initially relying on the exploitation of rubber, the regional economy underwent a first diversification as a consequence of the post-World War II rubber crisis: rubber tapping became supplemented with subsistence agriculture and Brazil nut extraction. This mode of making one’s living prevailed in the region for several decades until Bolivian rubber trade came to a standstill in the early 1990s. The recent rubber crisis called again for substantial modifications of the regional economy. This paper examines the conversion from a rubber based economy into production modes making broader use of forest resources. A village-level survey conducted in 163 rural settlements gave evidence that increased commercialization of Brazil nuts, palm hearts, and timber largely offset progressively lower incomes from rubber exploitation. In addition subsistence and market-oriented agriculture were expanded. Palm heart and timber extraction is likely to exceed natural regeneration rates, and therefore socio-economic needs and ecological requirements are yet to be reconciled in the post-rubber era of the northern Bolivian Amazon.

Key words: Amazon, Bolivia, rubber, Brazil nut, market-oriented agriculture, non-timber forest products, palm hearts, timber extraction

INTRODUCTION

Rubber exploitation in the northern Bolivian Amazon began on a large scale only after 1880, once a viable outlet to the Atlantic Ocean via the Beni and Mamoré-Madeira Rivers had been discovered (Fifer 1970). To meet the demand for labor on the emerging rubber estates, or barracas1, ten thousand of migrant laborers were recruited from Santa Cruz, the adjacent Yungas, and the valleys around Cochabamba (Zeitum 1991). Rubber production contributed 49% to Bolivia’s total export value in 1898 (Bieber 1984) but its production underwent several boom and bust cycles. Each rubber crisis not only imposed the adjustment of rural livelihoods and the reorganization of the barraca economy, but also gave a boost to communities founded by independent rubber tappers. The Treaty of Roboré, signed in 1958 by the governments of Brazil and Bolivia, granted market preferences to rubber from both Bolivia and Brazil (Pacheco 1992). Moderate

1The term ‘barraca’ not only referred to the territorial extension of a rubber estate but also to its river-based functional center around the patron’s hut (for a more detailed definition, see Stoian and Henkemans 2000).
production levels thus were retained until the mid 1980s. Following the abrogation of the rubber price support scheme in 1986 (DIIV 1993c), Bolivian rubber production came to a standstill as it could not compete with the far cheaper rubber from Southeast Asian plantations (CNF 1997).

This paper focuses on the economic re-conversion in the post-rubber era of northern Bolivia. In the first part it provides details on the rubber decline before it turns to the expansion of the Brazil nut, palm heart, and timber industries. The paper further addresses the growing importance of agriculture in the wake of the latest rubber crisis. The concluding section discusses the consequences of this transformation process for future resource use and the socio-economic development of the region. The paper is based on empirical data from a 1997 village-level survey conducted in about one third of the permanently populated settlements in the rural areas of northern Bolivia. Presentation of data is based on a settlement typology suggested by Stoian and Henkemans (2000).

**Economic re-conversion**

*The decline of rubber production*

During World War II, the United States and the Allies were cut off from the rubber supplies of Southeast Asian plantations. The resulting increase in demand for native rubber brought about a second rubber boom in the Amazon. In the post-war period, prices of native rubber slumped again and rubber production dropped to pre-war levels. This second rubber crisis lasted for about three decades (Figure 1). Throughout the 1950s and 1960s, official export values of native rubber from northern Bolivia averaged US$ 0.8 million per year. During the 1970s, they soared to an annual average of US$ 1.6 million. Fuelled by the oil crisis in 1973, rubber production doubled in the mid 1970s and nearly reached the boom years' levels in the wake of the second oil crisis in 1979. From 1980 to 1985, mean export values reached US$ 2.7 million per year.

By the mid 1980s, the repercussions of the oil crises had been overcome and the resulting decrease in demand for native rubber began to claim its toll in Bolivia. At the same time, Bolivia was hit by a severe economic and monetary crisis. The overvaluation of the Bolivian currency indirectly subsidized imports, while exports de facto suffered from an additional tax. This resulted in considerable contraband of products sold at the unofficial parallel rate (Pacheco 1998). Illicit export of rubber into Brazil was but one of the examples of illegal

---

2 'Post-rubber era' in the context of this paper refers to the period after 1986. On average, 1986 was the year when rubber production terminated in northern Bolivia. 'Rubber era' stands for the years from 1860 to 1986.

3 In his 1981 survey in northern Bolivia Romanoff (1992, citing IRSG 1983) found that 'rising oil prices were an impetus to natural rubber production at the time of the survey, with rubber prices in New York quadrupling between 1972 and 1980—but falling in 1981 and 1982, and again rising in 1983'.
trafficking. Bolivia’s economic crisis hit patrons, intermediaries, and rubber tappers alike. The latter could no longer afford to pay the increasing barraca prices for foodstuffs and basic necessities. As hyperinflation soared to 25,000% between January and August 1985 (Nohlen and Mayorga 1992), intermediaries ran the risk to be deprived of their profits when purchasing rubber in the forest at a rate that was worth much less upon their arrival in town. Many patrons could not retain regular payments to the rubber tappers or to the merchants delivering the basic supplies needed. As a result many tappers began to leave the barracas in search of a new living in an independent community or urban center (Stoian and Henkemans 2000). Deprived of the labor force and often heavily indebted, numerous patrons had to abandon their barracas.

Along with the general economic and monetary crisis, the final decline of Bolivian rubber production was inflicted by Brazil’s withdrawal of rubber subsidies in 1986. Over 28 years Bolivia had assumed a high dependence on them, with 95% of its rubber production being exported to Brazil (Weiss et al. 1989). Left to the forces of the world market, native rubber from Bolivia could not compete with the far cheaper plantation rubber from Southeast Asia or non

---

"The exact magnitude of contraband is unknown. In the late 1970s and early 1980s, Bolivian rubber production was at or above 4,000 tons according to patrons’ estimates (Romanoff 1992). Similarly, Weiss et al. (1989) estimated mean annual production at 4,200 metric tons between 1980 and 1987. In contrast, official statistics recorded a mean annual volume of 2,746 metric tons for the same period. With domestic consumption being little more than one percent, these figures suggest that about one third of the total production was illicitly exported."
Amazonian Brazil. In the late 1980s and early 1990s, Bolivian rubber production thus faded away gradually (Figure 1). The last year of significant rubber production was 1992, though small-scale production continued until the mid 1990s. The parallel decline of the volumes and values exported suggests that rubber prices were relatively stable though subsidies had ceded. In fact, prices oscillated within the narrow margin of US$ 0.92–1.07 per kg in the period 1986–1996 (CNF 1997). The decline of Bolivian rubber rooted in diminishing demand rather than a dramatic drop in prices, since the state-owned laminating plant which had absorbed about half the rubber production closed down in 1988 (Weiss et al. 1989).

Relative weight of rubber and Brazil nut production

The economic importance of rubber exploitation depended on the location-specific production potential on the one hand, and alternative sources of income on the other. Unlike the barracas where rubber lost its outstanding role only recently, many independent communities owe their foundation to a recession of the rubber market (Stoian and Henkemans 2000). Livelihood systems established in independent communities therefore needed to be less dependent on rubber-based income. Agriculture gained high importance in independent communities from their very beginnings. The regional economy was at the crossroads in 1986, as demonstrated by the values of rubber exports relative to those of Brazil nuts (Figures 2 and 3).

![Graph showing value of official Brazil nut and rubber exports from Bolivia between 1950 and 1986.](image)

Figure 2. Value of official Brazil nut and rubber exports from Bolivia between 1950 and 1986. Source: Based on Comité Cívico de Riberalta (1972), López (1993), CNF (1997) and Pacheco (1998).
For most of the period from 1950 to 1986 official export values of Brazil nuts equaled or outweighed those of rubber, save for the years prior to the Agrarian Reform in 1953 and the period 1980–1983. The general picture is that ever since World War II Brazil nuts have been equally important as rubber for both the regional economy and rural livelihood systems. Between 1951 and 1986, for instance, official Brazil nut and rubber exports annually averaged US$ 1.5 million and US$ 1.4 million, respectively (Figure 2). Furthermore, there is ample evidence that clandestine trade in rubber and Brazil nuts was roughly of the same magnitude (cf. Clay 1997).

Figure 3. Value of official Brazil nut and rubber exports from Bolivia between 1986 and 1998.

The year 1986 marked a clear turning point in the extractive economy of northern Bolivia. While Brazil nut exports were to experience a first boom, rubber production would ultimately be halted by 1996. Departing from the same level in 1986, official Brazil nut exports soared from US$ 3.5 million to US$ 30.9 million in 1998, while rubber exports dropped from US$ 3.8 million to nil (CNF 1997, 1998).

Bolivian rubber exports after World War II have generally been overestimated, as even in the best times of rubber export the real values reached to US$ 5 million only (Salas 1987). Long before the collapse of Bolivian rubber trade, collection of Brazil nuts thus was more than a 'complementary activity' to rubber tapping as suggested by Assies (1997). In the second half of the 1970s, for instance, i.e. at a time of high rubber prices, 'the annual income of a rubber tapper is approximately US$ 1,250, half of which originates from rubber tapping and the other half from the Brazil nut harvest' (Paardekooper 1978).
These figures suggest that flourishing Brazil nut exports might have displaced rubber production because of the former’s high economic returns. Yet, extraction of rubber and Brazil nuts was not mutually exclusive but highly compatible. First, these two principal commodities fitted well into the region’s agro-extractive cycle given their complementary seasons (DHV 1993d, Assies 1997). Second, each of the two products buffered times when markets were less favorable for the other. However marginal rubber income ultimately has been relative to Brazil nut earnings, rubber production ceased to be a profit contribution only recently.

**Boom of the Brazil nut industry**

Expansion of Brazil nut production in the context of a rubber crisis had a precedent in the 1920s. The then slack rubber market urged rubber producers to explore new forest products as alternative sources of income. Brazil nuts were discovered as new commodity (Ormachca and Fernández 1989) and their processing commenced in the late 1920s (CIDOB 1979b). At the onset of World War II, Suárez Hermanos and Seiler & Cfa. dominated in-country processing, with the export shares of shelled nuts and in-shell nuts amounting to 64% and 36%, respectively (Capriles and Arduz 1941, cited in Pacheco 1992). With the disintegration of the House of Suárez after World War II, in-country processing suffered a severe setback. During the 1950s and 1960s northern Bolivia chiefly exported in-shell nuts. By the end of the 1970s, however, four enterprises had established seven processing plants where the nuts were graded and packed for export. A renewed crisis of the shelling industry in the first half of the 1980s was succeeded by the rapid expansion of domestic processing capacity (Figure 4).

Bolivia’s Brazil nut economy was characterized by fairly stable harvesting levels throughout the 1970s, but in-country processing underwent a profound transformation. The share of the nuts processed domestically rose from 40% in 1970 to 93% in 1981. The respective remainder was exported in-shell to Brazilian processors, if not illegally trafficked in substantial quantities (CIDOB 1979a). By 1980, five Brazil nut plants closed down, leaving a monopoly on shelling with the two remaining plants operated by Hecker Hermanos. The latter’s relatively low production capacity forced most of the producers to export in-shell nuts to Peru or Brazil (Salas 1987). In 1986, even Hecker Hermanos had to suspend shelling due to lacking liquidity. The crisis of the Brazil nut industry in the first half of the 1980s coincided with the downturn in rubber production and Bolivia’s general economic crisis.

Bolivia’s New Economic Policy promulgated in 1985 sought to combat the crisis through trade liberalization and export promotion (Pacheco 1998). As a result, progressively higher exports of shelled nuts were realized during the second half of the 1980s. Along with an increase in world market price, 10

---

\(^6\)World War II, for instance, caused a heavy drop of Brazil nut production due to dwindling demand in the USA and Great Britain (Mori and Prance 1990). At the same time, Amazonian rubber production experienced its second boom, as the USA and their Allies were cut off from Southeast Asian rubber plantations.
In 1989, presumably one of the last years of significant contraband, the amount of Brazil nuts illicitly exported to Brazil was estimated at 6,000 metric tons or some 40% of overall production (MACA/BM 1990).

In 1997, for example, 9,833 metric tons or 491,676 boxes of shelled nuts were officially exported from Bolivia (CNF 1998). The raw material equivalent was about 1,720,000 boxes of in-shell nuts. With an estimated 470,000 boxes stemming from independent communities and 900,000 boxes from *barracas*, some 350,000 boxes must have been purchased from Brazil. These raw material imports became lucrative through adjustments of the Brazilian real against the US dollar and the resulting revaluation of the boliviano. In addition, the crisis in Acre's shelling industry deprived Brazilian producers from domestic outlets. Brazilian production dropped from 300,000 boxes in 1994 to 80,000 boxes in 1996 (Palacios 1998).

processing plants opened in Riberalta by 1990 (Salas 1987, Coesmans and Medina 1997). With the processing capacity being rapidly expanded, contraband of in-shell nuts decreased considerably (Pacheco 1992). By 1998, the number of Riberalta-based processing plants soared to 20 (Justiniano 1998). The previous need for in-shell exports thus gave way to the necessity for in-shell imports, as increased demand for raw material could not be met in Bolivia alone. From 1996 to 1998, about one fifth of the Brazil nuts processed in Bolivia originated from Brazil. Bolivia has been the world's largest exporter of shelled nuts since 1992,
while Brazil continues to be the largest exporter of in-shell nuts. In terms of raw material equivalent, though, Brazil’s share in the total volume of Brazil nuts traded dropped from 59% in 1992 to 37% in 1998. At the same time, Bolivia and Peru raised their world market shares from 36 to 50% and from 5 to 13%, respectively (Man-Producten 1997, 1998).

The Bolivian Brazil nut boom provides increasing income opportunities in both rural and urban areas. In 1997, about 5,500 persons, or 10% of Riberalta’s population, mostly female, found permanent or temporary employment in the shelling industry (Coesmans and Medina 1997). During the Brazil nut season from December to March, most of the processing plants release their labor force which constitutes the bulk of the about 5,500 collectors setting out from town to gather Brazil nuts on a barraca. They supplement the around 800 collector families who live permanently on the barracas. In addition, some 6,000 rural households gather Brazil nuts on their parcels in independent communities. About 1,500 collectors from these communities, among them approximately 200 without access to Brazil nut resources in their resident community, also leave for the barracas. In summary, the Brazil nut industry provides jobs and income to 5,500 persons in the processing plants and some 12,500 collectors or households from both rural and urban areas. Furthermore, some 500 contractors and several hundred intermediaries, captains, and truck drivers ensure that the raw material reaches the processing plants in time. The Brazil nut industry evolved as the single most important pillar of the regional economy over the past decade. However, the recent boom benefits the region’s rural settlements to widely varying degrees (Table 1).

Average collectors on a barraca gather 120 boxes per year, while their counterparts in independent communities produce 78 boxes annually.9 Accounting also for the rural settlements not sampled, total Brazil nut production amounted to about 1,370,000 boxes in 1997, two thirds of which originated from barracas and the remainder from independent communities. The latter increased their production from 240,000 boxes in 1992 (DHV 1993b) to around 470,000 in 1997. Though the harvested volume expanded in general, this increase reflects that the independent farmer sector gains increasing control of the Brazil nut resources, in particular in areas closer to town and along the expanding network of roads. In contrast, the barracas could increase their production only through exploitation of formerly unexploited Brazil nut stands in the region’s most remote areas. Results from our survey thus underpin a process called the ‘democratization of the Brazil nut economy’ (DHV 1993b).

Over the past five years raw material prices have more than doubled, thus further benefiting the rural small producers, among others. In 1998, Brazil nut collectors in barracas and independent communities respectively received US$ 4.5 and 7.5 per box as compared to US$ 2.2 and 3.1 five years before. Out of a total of US$ 10 million spent for the procurement of raw material, the

---

9 DHV (1993b) estimated collectors in independent communities to annually gather 57 boxes on average. This lower figure can be attributed to DHV’s disregard of the highly productive extractive communities along the Puerto Rico-Porvenir highway.
<table>
<thead>
<tr>
<th></th>
<th>Annual Brazil nut production</th>
<th>Mean Brazil nut production per settlement</th>
<th>Average amount of Brazil nuts per collector family</th>
<th>Average price of Brazil nuts in the season 1996/97</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(# boxes)</td>
<td>(# boxes)</td>
<td>(# boxes)</td>
<td>(Bs per box)</td>
</tr>
<tr>
<td><strong>Barracas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enterprise-run</td>
<td>137,300</td>
<td>9,807</td>
<td>111</td>
<td>19.3</td>
</tr>
<tr>
<td><em>barracas</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>large patron</td>
<td>118,450</td>
<td>5,384</td>
<td>145</td>
<td>19.6</td>
</tr>
<tr>
<td><em>barracas</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>small patron</td>
<td>18,150</td>
<td>825</td>
<td>109</td>
<td>20.8</td>
</tr>
<tr>
<td><em>barracas</em> in transition</td>
<td>69,900</td>
<td>4,660</td>
<td>111</td>
<td>22.6</td>
</tr>
<tr>
<td>Independent communities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>peri-urban communities</td>
<td>8,200</td>
<td>1,171</td>
<td>42</td>
<td>35.8</td>
</tr>
<tr>
<td>agrarian communities</td>
<td>1,770</td>
<td>98</td>
<td>5</td>
<td>33.7</td>
</tr>
<tr>
<td>agro-extractive communities</td>
<td>23,470</td>
<td>1,174</td>
<td>38</td>
<td>34.1</td>
</tr>
<tr>
<td>extractive communities</td>
<td>131,230</td>
<td>5,249</td>
<td>145</td>
<td>34.2</td>
</tr>
<tr>
<td>indigenous communities</td>
<td>22,050</td>
<td>2,450</td>
<td>78</td>
<td>33.3</td>
</tr>
<tr>
<td>rural sub-centers</td>
<td>223,500 *</td>
<td>27,940</td>
<td>105</td>
<td>30.8</td>
</tr>
</tbody>
</table>

Source: Village-Level Survey 1997; settlement stratification based on Stoian and Henkemans (2000).

Note: The number of collector families was derived by adding the number of resident families to the number of collectors recruited from outside the settlements. One boliviano (Bs) was equivalent to US$ 0.19 in February 1997.

One box of Brazil nuts measures 51*27*35 cm. At the transhipment point it typically contains 26 kg of in-shell nuts as opposed to the official weight of 22 kg (DHV 1993b).

*This figure includes some 100,000 boxes sold by patron-like intermediaries from three rural sub-centers (Puerto Rico, El Sena, Conquista) who continue to control part of the Brazil nut flow from these settlements at prices little below those offered on the free market.

Collectors' share was about US$ 6 million, equivalent to 21% of the export earnings accruing from the Bolivian trade in Brazil nuts. Patrons and intermediaries gained US$ 1.8 and 2.2 millions or 6.3 and 7.7%, respectively. Taking into account that many patrons, intermediaries and nearly half the collectors predominantly reside in town, an estimated US$ 3.5 million from raw material sales, or 12% of the Brazil export earnings, remained in the rural areas.

**Expansion of the palm heart industry**

Over the past decade, another non-timber forest product boomed in northern Bolivia, namely asaf (*Euterpe precatoria*). Hearts of this single-stemmed palm find ready markets in Brazil, Argentina and, to a lesser extent, some European

---

10 Figures presented in this paragraph refer to the shares of the Brazil nut trade within Bolivia though, as mentioned above, in 1997 some 20% of the raw material was purchased from Brazil. Since the cross-border flow of crude nuts is mainly clandestine, the benefits accruing to Brazilian collectors and intermediaries from raw material sales could not be determined exactly.
countries and Chile (CNF 1997). Palm hearts are extracted during eight months of the drier period between April and November, i.e. during the months when rubber used to be tapped. Exports provide high returns to the main production areas in Santa Cruz Department and the northern Bolivian Amazon (Figures 5 and 6).

Throughout the 1980s palm hearts were exported from Bolivia on a small scale but exports have surged dramatically since 1992. Out of a total of 26 canneries operating in 1997, 19 had been established in 1996 and 1997 alone (Stoian and Hofmann 1998). Northern Bolivia’s canning industry relies exclusively on palm hearts from wild stands of *E. precatoria*, as does the industry in Santa Cruz Department. Though the Santa Cruz export values include palm hearts extracted from peach palm (*Bactris gasipaes*) plantations in Cochabamba Department, they do not reach those of palm hearts exported from northern Bolivia (Figure 6).

The regional palm heart industry was initially established in town. Raw material was procured from surrounding forests, most of which are located within the sphere of independent communities. Their residents, however, were not necessarily the main beneficiaries in the thriving palm heart business. An emerging system of work crews recruited from urban areas at times resulted in fierce competition for raw material. Given the open access to the resource base, proper management techniques were hardly developed. The single-stemmed nature of *E. precatoria* implies the palm’s death upon removal of its heart. Irrespective of their urban or rural background, collectors tend to remove all mature individuals accessible. As a result, increasingly distant places need to be penetrated to reach to unexploited stands. Quality requirements impose the maximum distance from the road or riverside, as palm hearts are to be processed within three days after cutting.

Along with the establishment of rural canneries, new extraction sites became ever more distant from town. The outward movement of the palm heart industry

![Graph](image)

**Figure 5.** Volume and value of official palm heart exports from Bolivia between 1986 and 1998.
Figure 6. Value of official palm heart exports from northern Bolivia and Santa Cruz Department between 1993 and 1998.
Note: Export values of Santa Cruz Department include those of peach palm plantations (*Bactris gasipaes*) in Cochabamba Department.

was necessitated by the increasing number of entrepreneurs striving for participation in the lucrative business rather than the depletion of wild *Euterpe* stands in urban surroundings (Stolain and Hofmann 1998). Small rural canneries were founded by patrons in search for additional gains from their *barracas*. Medium and large factories, on the other hand, tended to be opened by large processors of Brazil nuts. By 1997, most of the sites apt for palm heart processing were occupied (Hofmann 1997).

In 1997, the palm heart industry of northern Bolivia processed 7.3 million palm hearts. It employed some 800 mainly unskilled and semi-skilled laborers recruited from town rather than from the local communities (Hofmann 1997). With few factories employing collectors, raw material is purchased from intermediaries and, to a lesser extent, from casual collectors. The quantity gathered depends on the type of collector, as well as access to the resource base. Urban and rural collectors supplied 22% and 78% of raw material, respectively. Next to the Brazil nut industry, the palm heart industry became the second most important source of income and employment after the demise of Bolivian rubber trade.

---

11From 1995 to 1997, the output of urban canneries virtually doubled, with their number increasing from three to nine.
12Casual laborers hired by contractors and taken to non-depleted stocks in open access areas harvest between 50 and 100 palm hearts a day. Depending on their assignments, they gather anything from few hundred up to 7,000 palm hearts a year. Forest-based collectors tend to have less access to palm heart resources. They gather between 10 and 60 palm hearts per day or 100 to 5,000 palm hearts a year. If not marked otherwise, the figures in this paragraph are derived from the survey of 120 households in four marginal neighborhoods of Riberalta and 150 rural households throughout northern Bolivia. The surveys were conducted in 1998 and 1999.
The purchase of raw material in the palm heart business accounted for some US$ 2.8 million in 1997 (Stoian and Hofmann 1998), some 75% of which were paid to the collectors while the remainder was pocketed by patrons and intermediaries. In other words, about US$ 2.1 million, equivalent to 26% of the total value of palm heart exports from northern Bolivia, accrued to those at the very beginning of the marketing chain. The shares of rural and urban collectors were US$ 1.5 million and US$ 0.6 million, or 18% and 7%, respectively. Employees from rural areas gained about US$ 300,000 in 1997 (cf. Hofmann 1997). Direct benefits from the palm heart industry accruing to the rural areas thus totaled US$ 1.8 million, or 21% of overall export value.

It needs to be emphasized that palm heart extraction is not practiced in a sustainable fashion. On average, extraction lasts 3.5 years in a given settlement before stocks are depleted. Recovery of the resource base to allow second cuts of similar magnitude are anticipated to take at least ten years (Johnson 1996). The palm heart industry alone can therefore not offset the cessation of rubber-based income. But timber extraction evolved as alternate dry-season activity.

Expansion of the timber industry

Commercial extraction of timber in Bolivia has long been confined to the Departments of Santa Cruz, La Paz and Beni (López 1996). In the mid 1980s, the annual cut in northern Bolivia was estimated at a mcrc 20,000 m³, the extraction of which provided employment to about 400 laborers (Salas 1987). By 1992, annual production rose to 64,000 m³, with Swietenia macrophylla (mahogany), Cedrela odorata (tropical cedar, cedro) and Amburana cearensis accounting for 91% of the total cut (DHV 1993a). This translates into an average annual cut of less than 0.01 m³/ha when considering the total forest area of about 10 million ha. But logging activities were mainly confined to Iturralde and Vaca Diez Provinces rather than covering the whole region. The volume effectively cut in a given logging area was therefore much higher. Nevertheless, timber extraction is very selective, and the visual damage to the residual stand is lower than in comparable logged-over rainforests.

In the wake of the latest rubber crisis this situation is about to change. In search of alternative sources of income, many barraca owners turned to permit timber extraction on their estates. Logging is carried out by work crews which are hired by sawmills providing the machinery needed. All staff except tree finders are recruited from towns due to the lack of skilled labor in rural areas. Likewise, the majority of the region's approximately 25 sawmills are based in towns. Until the late 1990s, state control on forest resources was virtually absent from northern Bolivia, thereby stimulating illegal practices that turned log extraction and processing into a lucrative business. Under the previous forest legislation, logging concessions had been granted for Iturralde and Vaca Diez Provinces, but only limited sections of Pando Department. As timber was extracted throughout the region, logging operations were for the most part illegal. Under the new Forest Act, promulgated in 1996, most former concessions were annihilated and a new regime of forest concessions was introduced. By 1997, 19 contract areas had been granted in Pando alone, covering 1.5 million ha or 25% of the land surface (Superintendencia Forestal 1997).
munities, however, were reimbursed only marginally for the logs they provided. Valuable species like *Swietenia macrophylla* and *Cedrela odorata* sold at US$ 15–30 per stem, while other species yielded US$ 10 or less. On the other hand, logging companies opened up forest tracts otherwise inaccessible to forest-based residents. The majority of them view road construction a positive spin-off of timber extraction. Being mainly located along the borders with Peru and Brazil (CPTI-CIDOB 1997), new timber concessions only marginally overlap with the zone from which Brazil nuts are extracted.

Two types of enterprises are involved in timber processing. First, it is the well established Brazil nut (and former rubber) houses, such as Hecker, Vargas, and Bezerra, which are also involved in palm heart processing. Second, Santa Cruz-based enterprises recently entered the region as timber supplies in other parts of Bolivia are dwindling. They established sawmills on their *barracas* close to the source of raw material. Similar to the palm heart industry, a previous urban-based industry spreads throughout the region and new extraction sites are ever more distant from town. The timber industry's move into progressively more remote areas has been most pronounced after 1992, coinciding with the last years of rubber production.

The expansion of logging activities came along with a diversification of the species extracted. In pristine forest, nowadays encountered only in the more remote pockets of the region, logging focuses on *Swietenia macrophylla* and *Cedrela odorata*. In forests where these species have been cut, attention turns towards lesser-known and/or commercially less valuable species, such as *Amburana cearensis*, *Cedrelinga catenaeformis*, *Alnus* spp., *Vochysia* spp., *Astronium* spp., *Mezilaurus itauba*, *Manilkara* spp. and *Tabebuia* spp. The advance of the timber and palm heart fronts is reflected in the increasing percentage of rural settlements affected by logging and palm heart extraction (Figure 7).

By 1992, timber or palm heart extraction had commenced in less than a fifth of the 163 settlements surveyed. But along with the progressively lower income from rubber tapping, their share soared to about three quarters by 1996. The need for compensative income from palm heart and timber extraction had thus become imperative in the majority of settlements. Figures are scarce, but the distribution of benefits from the timber industry appears to be even more skewed towards the urban areas. In 1997, an estimated US$ 2.5 million, or 13 % of export value, were paid to those providing logs from *barracas* and independent communities. The sawmills are located in both urban and rural areas but, as mentioned before, they heavily rely on laborers recruited from town. Rural income from wood processing is estimated at around US$ 300,000 per year.

---

14Given the comparatively low production costs, these nominal prices indicate that most of the profit accrues to the sawmills. In 1997, sawnwood of mahogany and cedar sold in Riberalt in at US$ 400-450 per m³ and US$ 320-350 per m³, respectively. In many cases, one trunk of these species comfortably yields 1.7 m³, that is, the round wood equivalent to 1 m³ of sawnwood.
Figure 7. Percentage of northern Bolivian settlements affected by timber and palm heart extraction between 1986 and 1996.
Source: village-level survey data (1997) from this study.
Note: Cumulative percentage of rural settlements (n=163) from which timber and/or palm hearts have at least once been extracted.

Expansion of agriculture

The latest rubber crisis initiated or reinforced the transition from extractivism to peasant agriculture. Many independent communities underwent a process of diversification, with agriculture gaining importance in addition to the increase in Brazil nut gathering (Ormachea and Fernández 1989). In the early 1980s, for instance, the area cultivated in the Departments of Beni and Pando was estimated at 18,000 ha and 3,000 ha, respectively (Torrico 1983). By the early 1990s, these areas rose to around 33,000 ha and 15,000 ha, respectively (INE 1999a,b).\textsuperscript{15} This process of agricultural expansion is even more remarkable given the rural exodus that affected both Pando and Vaca Diez (Stoian and Henkemans 2000).\textsuperscript{16}

On barracas and in independent communities the land annually cleared per family averages 1.4 ha and 2.0 ha, respectively. Settlers who recently migrated from a barraca to an independent community tend to increase the area they annually clear for agriculture. Along with the general expansion of arable land, commercialization of agricultural produce increased. This development was most prominent in independent communities located at the roadside given their better access to urban markets.

\textsuperscript{15}In addition to the expansion of cultivated land, cattle ranching increased in some parts of the region, in particular in the Province of Nicolás Suárez and along the major highways. But this expansion can only partly be related to the latest rubber crisis, as many cattle ranchers have been involved in this business for more than twenty years and relatively few patrons turned to cattle raising after the collapse of rubber trade (Caballero and Eduardo 1996).

\textsuperscript{16}From 1986 to 1993, for instance, arable land in the Province of Nicolás Suárez increased by 1.940 ha, or 17% (Keizer 1993), though its rural population decreased by 31% from 1985 to 1992 (INE 1986, INE 1992).
At a first glimpse, the latest rubber crisis in northern Bolivia has been overcome without major turbulence in the region. The experience of two rubber crises earlier this century contributed to cope with the third and presumably irreversible rubber crisis. Phenomena like out-migration from the former rubber estates, foundation of independent communities on abandoned estates, expansion of agriculture, and the turn towards alternate forest products are adaptive responses well-known from earlier crises. New, however, was the magnitude of migratory flows and, more important, the shifts in value generated from forest product extraction.

Latest export data from the northern Bolivian recorded an overall NTFP export value of little less than US$ 38 million, with Brazil nuts and palm hearts contributing US$ 30.8 million and US$ 7.1 million, respectively (CNF 1999). In 1980, at a time when Bolivian rubber trade flourished, the official export values of rubber and Brazil nuts combined amounted to US$ 7.5 million. In addition, annual timber exports rose from US$ 1.2 million in the mid 1980s (Salas 1987) to about US$ 20 million by 1997. Exports of forest products from northern Bolivia thus totaled little less than US$ 60 million in 1997. Adjusting for inflation and former contraband, this is about double the value of the most lucrative years prior to the latest rubber crisis.

In the first place, it is the thriving Brazil nut industry that sets the pace in the regional economy. Unprecedented export earnings had repercussions on other branches of the economy and, to a certain extent, trickled down to the collectors. Part of the capital accruing from the Brazil nut boom has been reinvested by the shelling industry in other business, such as timber, palm heart or gold exploitation, if not agribusiness. While in the late 1980s and early 1990s some of these horizontally integrated enterprises purchased barracas from large patrons to get hold of the resource base, they nowadays strive to obtain forest concessions under the new forest legislation. In this process, old-established local firms fall behind the Santa Cruz-based enterprises. This is the underlying reason why only a relatively small fraction of the earnings derived from Brazil nut exports circulates within northern Bolivia. The major part of capital is transferred to urban centers outside the region, namely Santa Cruz and La Paz, if not abroad.

The situation in the palm heart and timber industries is similar to that of the Brazil nut industry in that the major part of benefits is retained in the urban centers from where most of the profit is transferred outside the region. But unlike the Brazil nut industry, these industries are dispersed throughout the region and offer employment opportunities in rural areas. Nonetheless, they recruit a substantial number of laborers from town due to the lack of skilled labor in rural areas. Even semi-skilled and unskilled labor is difficult to secure as the local labor force is said to be too unreliable to be employed on a permanent basis. Those who are recruited from town stay at least for a season given that there is little incentive to suspend work in places where most of them live without their families. These laborers mainly comprise recent rural-urban migrants who otherwise are largely deprived of urban employment opportunities given their lack of formal education.
Participation in the extraction and processing of forest products is a prerequisite for their families' economic survival in town.

Notwithstanding the need for more accurate data, it is concluded that northern Bolivia's Brazil nut, palm heart and timber industries combined generate rural income of about US$ 8 million per year.¹⁷ This is equivalent to 14% of the overall export value of forest products. Taking further into account the high involvement of urban-based extractors and laborers, these industries prove to be indispensable sources of income for the poorer sections of society throughout the region.

Without doubt, there is a recent trend in northern Bolivia to foreclose future opportunities for current residents by depleting forest resources such as asai palm heart and valuable timber species. But timber resources in Pando, Iturralde and Vaca Diez are excessive and may well last for several decades even if not too carefully managed. In contrast, the palm heart industry will run out of raw material within less than ten years, unless plantations are established on a large scale (Hofmann 1997). Efforts to secure future supplies of raw material by cultivating peach palm (Bactris gasipaes) are worthwhile "(PROM AB 1998)". But even if they were successful on a large scale, incomes generated from palm heart extraction will not be as evenly distributed throughout the region as they are today. Plantations will be established close to the processing plants, as high requirements for capital, know how, and labor impede decentralized solutions. Many rural and urban households now involved in palm heart extraction will thus be compelled to search for alternate sources of income.

From the perspective of rural households, the year-round agro-extractive cycle that combined subsistence agriculture with rubber tapping and Brazil nut collection altered notably and the respective income shares changed accordingly. Around 1980, for instance, the mean extraction-based income of rural households was about US$ 900, with rubber and Brazil nuts accounting for US$ 500–600 and US$ 350–400, respectively. In 1998, Brazil nuts and palm hearts combined yielded a mean income of around US$ 800, with contributions of US$ 500–650 and US$ 150–300, respectively.¹⁸ When allowing for the income from timber extraction, today's forest-based income is virtually of the same magnitude as

¹⁷This amount compares with the sparse funds governmental institutions provide to the rural areas. In 1997, US$ 1.2 million were made available through Popular Participation, FIS (Fondo de Inversión Social) invested US$ 0.5 million for schooling and health facilities, and US$ 1.5 million of forest royalties were transferred to the departmental governments and municipalities (PNUD 1998, Superintendencia Forestal 1998).

¹⁸Average values, though, conceal the high variability among different types of collectors. In some independent communities, in particular those close to an urban center, conversion of natural high forest to arable and pasture reduced the number of Brazil nuts trees so effectively that the average income from the Brazil nut harvest does not exceed US$ 150 per parcel. In contrast, households in extractive communities each may derive up to US$ 2,500 from the sale of Brazil nuts from their parcels. High variability of extractive incomes is also typical for the Pacaya-Samiria National Reserve of Peru 'where the mean annual incomes from extractive products were in the order of $300–400 per year' but 'the variation across households was generally between $0 and $1500 per year, reflecting quite distinct levels of extractive activity and reliance across households' (Coomes and Barham 1997).
about 20 years ago. Rubber tapping as main dry-season activity has largely been replaced by palm heart collection and, to varying degrees, timber extraction. For the time being, extraction of palm hearts and timber along with increased earnings from Brazil nut gathering offset income losses associated with the latest rubber crisis. Moreover, market-oriented agriculture has been expanded in all but the most remote settlements. Without doubt the adjustment of rural livelihood strategies has been successful in economic terms. But do they meet other criteria of sustainable development the same way?

Doubtlessly sheer economic needs largely determine the level of acceptance of extraction-based livelihoods. What may appear as socially unacceptable from an outsider’s point of view may well be accepted by local people in the light of lacking alternatives. In the view of numerous ex-rubber tappers one of the few alternatives has been migration to town. Living in the marginal neighborhoods of peri-urban areas, many of them maintain their linkages to the rural areas and derive a substantial part of their income from forest products. Others whose expectations had not been met in town have returned to a peasant living in one of the independent communities. Both peri-urban and rural livelihoods thus continue to depend on the collection and processing of NTFPs even more than 150 years after the advent of their commercial exploitation.

Through time, products, markets, and politics have changed. Some forest products are prone to lose significance because of overexploitation, e.g., hides and skins of forest animals or, more recently, mahogany and asaf (Beekma et al. 1996, PROMAB 1998); others, like Peruvian bark and rubber, vanished in the light of competition from cheaper production in plantations—purportedly a general trend of forest product extraction in Amazonia (Honma 1992). On the whole, however, the adaptive capability of the region’s population ensured that a rural living can still be secured from a combination of agriculture and extractivism. Shifts in forest product extraction thus are a key element of rural livelihood systems which show a high degree of persistence, if not sustainability. Similar shifts in the commercialization of forest and fallow products had been observed, for example, in the Peruvian Amazon (Padoch 1988, Coomes 1995). But the related livelihood systems are not viable without a mainstay in agriculture. Unlike the Peruvian Amazon, agricultural development in northern Bolivia is still in its infancy. With many forest dwellers being extractivists rather than agriculturists, agricultural systems lack the sophistication and diversity of swidden fallow agroforestry as practiced elsewhere in the Amazon or Southeast Asia. Nonetheless, agriculture needs to be the backbone of rural livelihoods given the vagaries of international forest product markets.

Extraction-based incomes will remain to be essential as long as the promotion of more diversified agroforestry systems fails to yield significant results (cf. Nepstad et al. 1992). If the efforts to market new forest and fallow products were to fail, alternative and, most likely, more destructive land-use systems would

---

19 As monetary transactions of rural households are effected in local currency, diachronic comparisons do not need to account for inflation when done in US dollars. Exchange rate adjustments of Bolivian currency against the US dollar well reflected domestic inflation over the past two decades.
emerge in the region. The NTFP-based industry would shift more than before to logging and cattle ranching. From the forest dweller’s perspective, the lack of capital and formal skills leaves little options beside the expansion of agriculture, predatory use of timber, or migration to urban areas in search of wage labor.

ACKNOWLEDGEMENTS

The German Ministry for Economic Cooperation and Development (BMZ) and the Center for International Forestry Research (CIFOR) are thanked for providing the funds for this study. The author is particularly grateful to Wil de Jung, as well as Michel Becker, Emile Verheule, Ariëenne Henkemans, Jochen Statz, Alan Bojanic, and two unknown reviewers for their valuable comments on earlier drafts of the paper. Martin Barker did an invaluable job in editing. Thanks are also due to the colleagues from the Programa Manejo de Bosques de la Amazonía Boliviana (PROMAB) and the Markets and Marketing Section at the University of Freiburg.

REFERENCES


Capriles and Ardis 1941. El problema social en Bolivia. La Paz, Bolivia.

CIDOB. 1979a. Diagnóstico social del norte Boliviano—Volumen I. Centro de Información y Documentación de Bolivia (CIDOB), La Paz, Bolivia.

CIDOB. 1979b. Diagnóstico social del norte bolivianos—Volumen II. Centro de Información y Documentación de Bolivia (CIDOB), La Paz, Bolivia.


cotidiana de las mujeres campesinas y quebradoras de Riberalta y sus alrededores. W Producciones, La Paz, Bolivia.


