

**Change and adaptation as keys to sustainability:  
extraction-based livelihood systems in the Bolivian Amazon**

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**Abstract**

Commercial exploitation of non-timber forest products (NTFPs) has been playing a major role in the northern Bolivian Amazon for more than a century. Extraction of forest products, such as rubber, Brazil nuts, and palm hearts has traditionally been the major source of cash income in rural areas. Agriculture is mainly for subsistence and the importance of wage labor has increased only recently. Extraction-based livelihoods are subject to changes triggered by the dynamic nature of NTFP markets and, partly, overexploitation of the species concerned. When focusing on individual NTFP production systems, none of them could be considered sustainable. If, however, extraction-based livelihood systems are viewed on a long-term basis and as a whole, criteria of sustainability are more readily met. Along with residential mobility, the region's population renders rural livelihoods economically viable and socially acceptable through continuous adaptation of trade-offs between agricultural and extractive activities. Overexploitation of species occurs, if at all, over limited time and space. Extraction-based livelihood systems in northern Bolivia can thus be considered sustainable.

Keywords: rural livelihoods, non-timber forest products, swidden agriculture, Bolivia, Amazon

**Introduction**

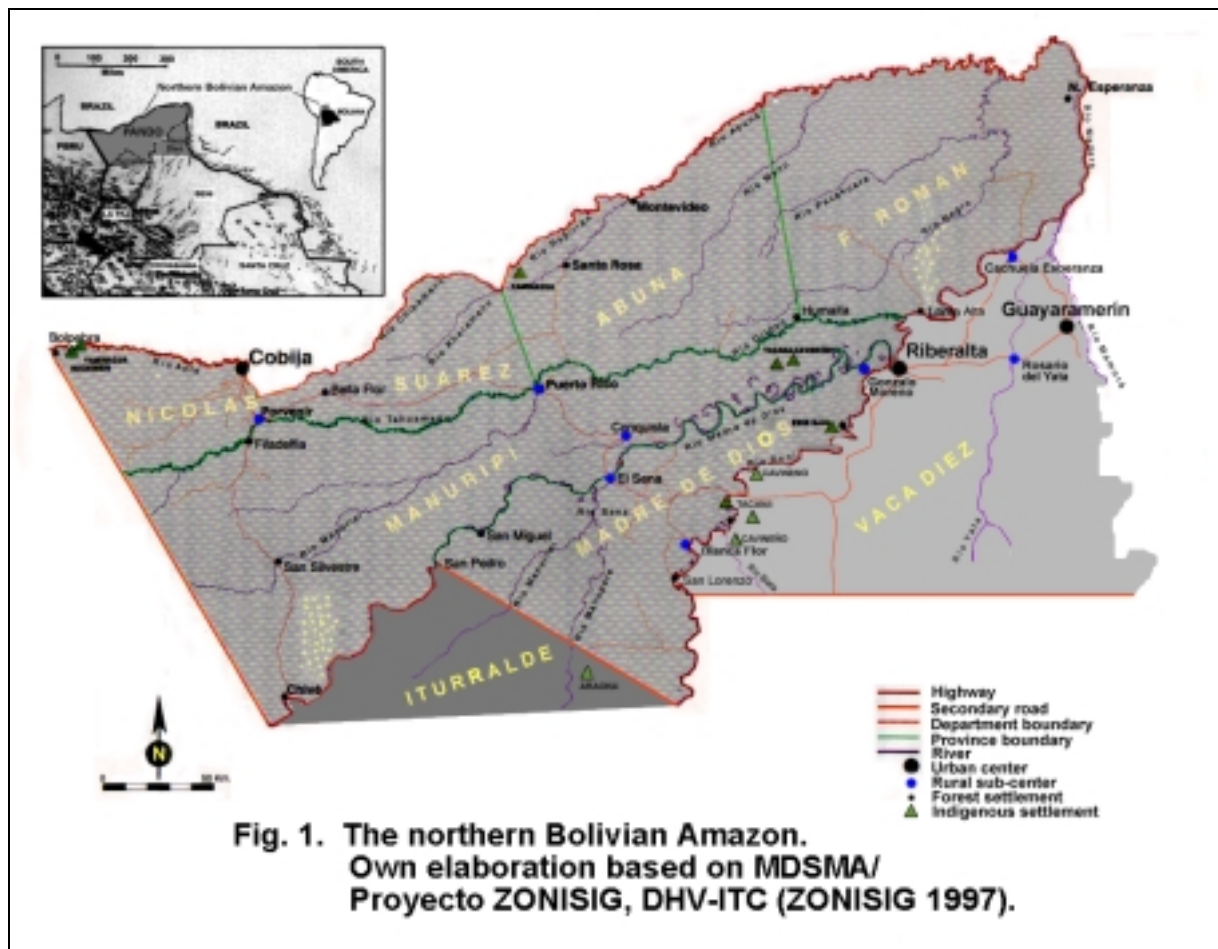
Tropical forests in Amazonia make up the largest contiguous rain forest area worldwide. In addition to the extraordinary variety of animal and plant species, millions of forest dwellers, both indigenous peoples and colonists, depend on these forests. Increasing deforestation in the Amazon thus not only endangers the conservation of biodiversity but also the survival of various social and cultural life forms. In search for "alternatives to deforestation" (Anderson, 1990), some scientists began to advocate the utilization and marketing of non-timber forest products (NTFPs) as means to generate income from the forest without compromising their biodiversity (De Beer and McDermott, 1989; Nepstad and Schwartzman, 1992; Plotkin and Famolare 1992). More recently, however, the initial enthusiasm about NTFPs gave way to a more realistic view on the opportunities and limitations of their increased marketing (e.g. Ruiz Pérez and Arnold, 1996; Freese 1997; Wollenberg and Ingles, 1998).

In the northern Bolivian Amazon, rural livelihoods have traditionally been based on a combination of (subsistence) agriculture and forest product extraction. Timber is being extracted very selectively and, from a rural perspective, generates only marginal returns. The majority of rural households depends on the extraction of NTFPs as major source of cash income. In the course of time, however, markets for NTFPs were subject to pronounced fluctuations. Certain products were deprived of a market because of changes in international demand, while others were affected by diminishing supply due to overexploitation. More than once during the 20th century, the region's rural population had to respond to crises of NTFP markets. This paper aims to highlight the capability to adapt to change as key factor for the

sustainability of extraction-based livelihood systems. After introducing the study area and the methodology applied, it first focuses on the history of the region's extractive economy. The next chapter deals with extraction-based livelihood systems in the light of change. Finally, some conclusions are drawn on their future perspectives.

### Study Area

Two thirds (729,000 km<sup>2</sup>) of Bolivia are part of the Amazon Basin (Superintendencia Agraria 1997: 5), but only the northern Bolivian Amazon is covered by Amazonian moist forest in which rubber (*Hevea brasiliensis*) and Brazil nut (*Bertholletia excelsa*) trees abound (Harcourt and Sayer 1996: 220f). This region, here also referred to as northern Bolivia, was chosen as study area. It comprises the five Provinces of Pando Department, the Province of Vaca Diez (Beni Department) and the northernmost part of the Province of Iturrealde (La Paz Department). The region covers an area of about 100,000 km<sup>2</sup> and is bordered by Peru to the west and Brazil to the north and east (Figure 1).



In 1999, the region's population was around 150,000, more than two thirds of whom reside in the three principal towns, viz. Riberalta, Guayaramerín and Cobija. Little less than one third of the population lives in rural areas. Low population density, along with limited accessibility and distance from major markets result in comparatively low pressure on the forest resources. Of the land surface, 94 % is covered by largely intact forest, 3 % by forest fallows and another 3 % by arable and pasture (Beekma et al., 1996: 53).

The northern Bolivian Amazon has an estimated 700 rural settlements, about two thirds of which are permanently inhabited. They can broadly be distinguished into *barracas*, former rubber estates that are controlled by large patrons (*patrones*) or enterprises, and independent communities. The latter owe their existence to one of the rubber crises earlier this century. The conversion of *barracas* into independent communities is an ongoing process (Stoian and Henkemans, forthcoming).

### **Methodology and methods**

Field data was collected in two phases, viz. village-level and household-level surveys. Between January and June 1997, 163 rural settlements were surveyed along the main roads and rivers throughout the seven provinces of northern Bolivia. These settlements were home to 3,737 family units with some 22,000 people, equivalent to roughly half the region's rural population. The survey yielded, *inter alia*, a settlement typology allowing to distinguish four types of *barracas* and six types of independent communities (Stoian and Henkemans, forthcoming). Based on this typology, 27 rural settlements were selected for conducting a household-level survey between December 1997 and August 1998 and from March to April 1999. The 151 households included in the sample were selected at random.

During the first phase, semi-structured interviews, participatory observation, and group discussions were applied to obtain information on village infrastructure, land tenure, agricultural production, forest product extraction, trade and migration patterns, as well as social organization and external support from governmental or non-governmental organizations. Interviewees were elected or appointed village leaders in the case of independent communities, and patrons, administrators, or caretakers in the case of *barracas*.

In the second phase, a similar mix of methods was applied as in the first phase. The household survey focused on demography, migration history, education and skills, land use and tenure, income from agriculture, forest product extraction, wage labor and other remunerative activities, as well as organizational aspects. Respondents were household heads, in many cases assisted by spouses and other knowledgeable household members.

### **History of the extractive economy in northern Bolivia**

The northern Bolivian Amazon had long been inhabited by indigenous peoples, making their living from hunting, fishing, and forest product extraction. Their predominantly nomadic character prevented most of them to practice agriculture (CIDOB, 1979: 136). By the mid 19th century, their isolation was partly revoked as Bolivian and Brazilian explorers entered the region in search of Peruvian bark. Though extraction of the quinine-yielding bark of *Cinchona spp.* experienced a boom in the mid 19th century, it was not before 1880 that the region became fully integrated into the world economy. In that very year, large-scale rubber exploitation became feasible in northern Bolivia, as the exploration of the lower Beni river resulted in the discovery of the Beni-Madeira river system as a viable outlet for the rubber riches. The subsequent advance of the rubber frontier forced the vast majority of the region's indigenous groups into an oppressive labor system (Fifer, 1970: 137). As the demand for labor could not be met by the native population alone, ten thousands of laborers were recruited from outside the region (Sanabria, 1958: 94f).

Rubber production was organized on so-called *barracas*, large rubber estates controlled by a patron. The patrons provided the rubber tappers with basic goods at highly inflated prices in return for the rubber tapped. In order not to divert the labor force from rubber tapping, the rubber workers were forbidden to practice agriculture. The tappers' dependency upon the patrons was reinforced through the virtual exclusion of monetary transactions (Becerra 1984:

60f). With the patrons being in the position to stipulate the *barraca* prices for rubber and the basic necessities at their own discretion, most of the rubber tappers became permanently indebted.

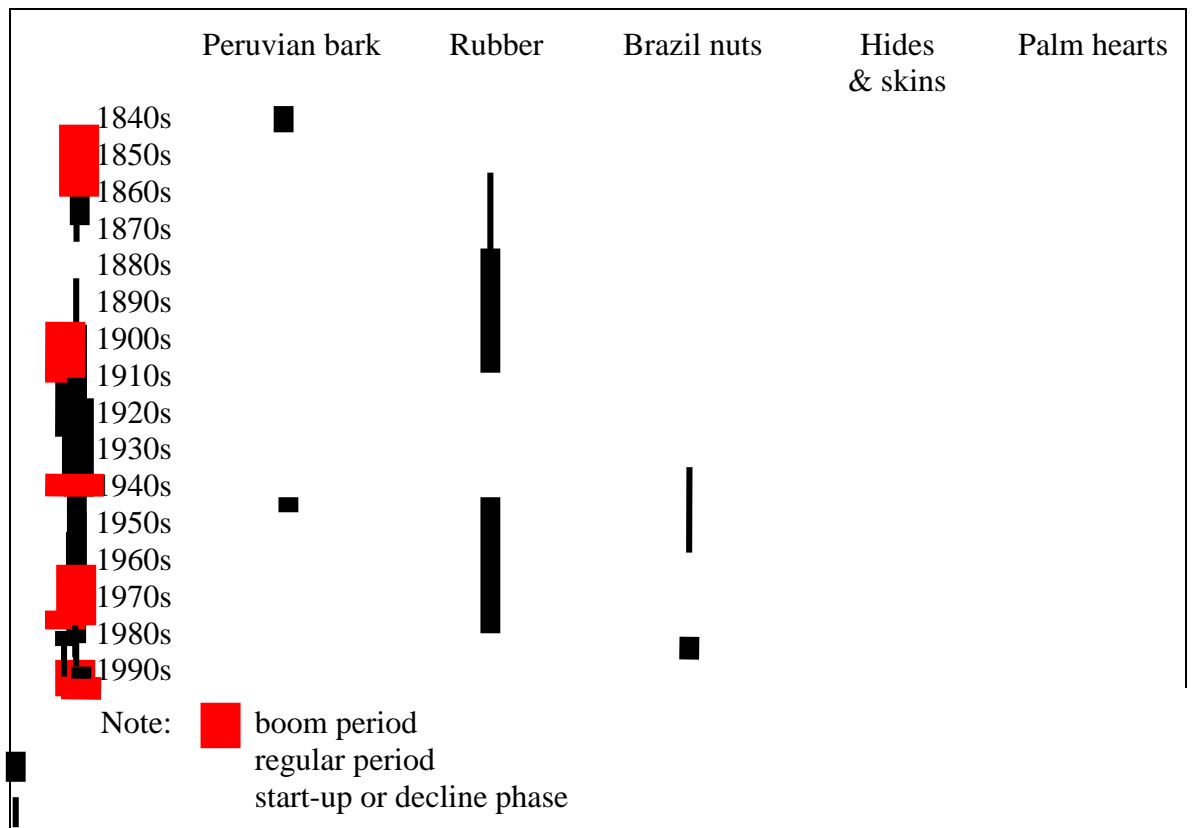
The rigid debt peonage system underwent modifications in the wake of the inter-war rubber crisis. Since many patrons were no longer able to provide the tappers with foodstuffs, they relaxed restrictions on agriculture. In addition, they turned to the exploitation of Brazil nuts to offset for income losses owing to the rubber decline (CIDOB 1979). In the 1930s, a new production mode thus came into existence, embedded in a so-called agro-extractive cycle (Assies 1997: 8). It was practiced not only on the *barracas* but also in independent communities which were founded on *barracas* abandoned by those patrons who were heavily indebted.

This agro-extractive cycle signified the combination of swidden agriculture and the extraction of rubber and Brazil nuts. The nuts are collected during the rainy season from December to March, while rubber is tapped in two periods from April to June and September to November, respectively. In July and August, at the peak of the dry season, rubber tapping is suspended and labor dedicated to the clearance of new agricultural fields by means of slash-and-burn. Rice, maize and plantains are sown from October to November or December just before the next Brazil nut harvest commences. Manioc is propagated by cuttings or sown in April and May. Between February and April, harvesting of rice and maize coincides with the last months of the Brazil nut season. Plantains and manioc, though, can be harvested throughout the year and thus provide staples (CIDOB 1979: 153, SNDR 1995: 76, Assies 1997: 8f).

The traditional agro-extractive cycle prevailed in the region as long as rubber production was economically viable. But native rubber from the Amazon suffered from pronounced price fluctuations. These boom and bust cycles were triggered by increased production of plantation rubber and synthesized rubber on the one hand, and economic or political crises on the other. The world market for native rubber recovered several times, but at the end of the 20th century it has reached a deadlock. In northern Bolivia, rubber production terminated in the late 1980s and early 1990s. The decline called for substantial modifications of the agro-extractive cycle and, hence, rural livelihood systems as a whole.

The demise of native rubber brought about the reorganization of the *barraca* economy, along with pronounced migration from the former rubber estates to independent communities or urban centers (Stoian and Henkemans, forthcoming). In addition, an ephemeral gold rush in the late 1980s and early 1990s absorbed considerable numbers of the *barracas'* erstwhile labor force. Next to gold, both entrepreneurs and extractivists turned to increasingly exploit Brazil nuts, palm hearts (Figure 2), and, to a lesser extent, timber.

Figure 2: Dynamics in the extractive economy of the northern Bolivian Amazon, 1840-2000

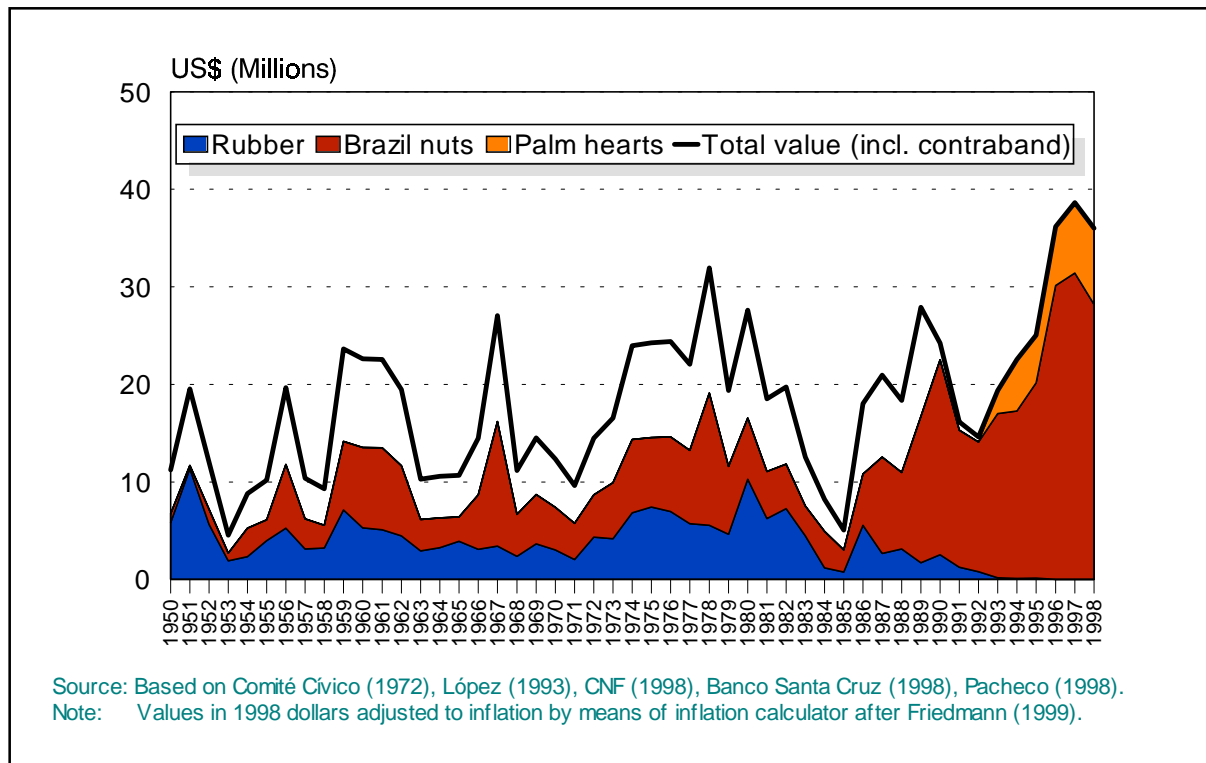


The extractive economy of northern Bolivia underwent several boom and bust cycles. Periods of low demand for a specific NTFP were mostly buffered by concomitant higher demand for another forest product, if not an array of products. Peruvian bark was the first commercial product extracted from northern Bolivian rain forests. The boom years between 1847 and 1864 (Becerra, 1984: 23) were succeeded by declining demand on the world market as *Cinchona* plantations established in Southeast Asia set out to produce on a large scale. However, the simultaneous rise in demand for native rubber stimulated many bark entrepreneurs to turn to the upcoming rubber trade. The first rubber boom in Bolivia lasted from 1900 to 1913. But native rubber was to suffer the same fate as Peruvian bark, with rubber plantations being established in British India. Far cheaper plantation production would soon outstrip the importance of wild rubber from the Amazon. The post-World War I rubber decline, in turn, was addressed with the search for alternate forest products. In the late 1920s, Brazil nuts thus emerged as a complement to rubber.

During World War II, the demand for NTFPs from the northern Bolivian Amazon was to change again. The Japanese war in the Pacific cut off the United States and the Allies from the rubber and *Cinchona* plantations in Southeast Asia. As a result, demand for native rubber and Peruvian bark from the Amazon soared and almost reached the boom years' levels. All efforts were consequently directed to their extraction and, for some years, Brazil nuts were relegated to a residual role. Soon after the war was over the picture turned again. Peruvian bark would enter its ultimate decline owing to increased production of synthesized quinine and new plantations emerging in the Congo basin. The fortune of rubber in the post-war period was hardly different, as production of plantation and synthetic rubber ousted native rubber from international trade. Thanks to high demand for rubber in Brazil that could not be

met from domestic production alone, the Brazilian government had launched a rubber price support scheme that was extended to native rubber from northern Bolivia. Lifted to approximately three times the world market price through subsidies (Fearnside, 1989: 390), rubber production in Bolivia continued at modest levels. At the same time, Brazil nut extraction regained importance such that, between the end of World War II and 1986, mean export values of rubber and Brazil nuts were virtually of the same magnitude (Figure 3).

Figure 3: Export values of rubber, Brazil nuts, and palm hearts from northern Bolivia, allowing for inflation and contraband, 1950-1998



The mid 1980s marked a clear turning point in the extractive economy of northern Bolivia. In 1986, Brazil abrogated its rubber subsidies so that production of Bolivian rubber, left to the forces of the world market, came to a standstill in the mid 1990s (cf. CNF 1998). Over the past decade, two NTFPs largely offset for progressively lower income from rubber tapping, namely Brazil nuts and palm hearts. The latter are extracted from wild populations of *Euterpe precatoria*. In 1997, 26 canning factories processed about 7.3 million palm hearts (Hofmann, 1997). Due to the single-stemmed nature of *E. precatoria* the palm dies upon removal of its apical meristem that yields the palm heart. This is one of the reasons why the extraction front proceeds to ever more remote sites, with the factories following accordingly, as palm hearts need to be processed within three days after cutting (Stoian, forthcoming).

Official statistics only partly reveal the true scale of NTFP exports; best documented are those of rubber, Brazil nuts, and palm hearts. Not only the illicit trade in hides and skins but also contraband of legal products conceals a significant part of trade in NTFPs. It is estimated that around one third of the total production of rubber and Brazil nuts in Bolivia until the end of the 1980s was illegally trafficked to Brazil and Peru (cf. Vivado, 1984: 140; Weiss et al., 1989: 39; Romanoff, 1992: 134). Over the past decade, contraband of the major forest products has almost disappeared, since both the Brazil nut and palm heart industries have

extended their production capacities to such an extent that competition for raw material resulted in increasing prices paid to the providers (Stoian, forthcoming).

In addition to well-known forest products, such as rubber, Brazil nuts, or palm hearts, further NTFPs supplemented forest-based incomes, e.g. hides and skins of forest animals such as caimán (*Caiman spp.*, *Melanosuchus spp.*), lagarto (*Caiman spp.*), tigre (*Panthera onca*), tigrecillo (*Leopardus wiedii*), londra (*Pteronura brasiliensis*), and taitetú (*Tayassu tajacu*). Animal-based NTFPs, including living birds and monkeys, have been exported as far back as the early days of rubber production. A peak of the illicit trade was reached in the early 1970s, coinciding with low returns from rubber and Brazil nut sales. By the late 1970s, caimans and lagartos had almost been extinguished by hunters, and the increased interest in hides of Felidae inflicted the menace of their extinction (Boero R., 1978: 496). As a consequence, government control became more strict in the 1980s and changing international demand through increasing environmental awareness resulted in the collapse of this market by the end of that decade. Similar tendencies can be observed as regards palm heart extraction, since the Bolivian government is about to pass new rules and regulations aiming at the preservation of the resource base through a compulsory plantation program.

### Extraction-based livelihoods in the light of change

Shifts in forest product extraction as described above at regional level, became manifest in pronounced changes at household level, too. The collapse of rubber production, for instance, led to a major reshuffling of the rural population. Many estate owners and rubber tappers left the *barracas* for a life in one of the region's urban centers. Nowadays they return to the estates only in time of the Brazil nut harvest. Other *ex-barraca* dwellers opted for a rural livelihood in an existing or one of the newly emerging independent communities. In 1997, 89 % of the rural population resided in such a community, while a mere 11 % remained on the *barracas* (Stoian and Henkemans, forthcoming).

Independent rural dwellers in northern Bolivia can be characterized as follows:

- common background as rubber tappers and/or Brazil nut gatherers but lack of agricultural tradition
- extraction-based income often main source of cash income
- slash-and-burn agriculture mainly for subsistence
- (agricultural) wage labor increasingly important
- parcel size averages 50 ha (ranging from 10 to 500 ha), out of which  $\approx$  30 ha are high forest, 15 ha forest fallow, and 5 ha agricultural plots
- no application of farm inputs
- low agricultural output due to pests, low-yielding varieties, adverse weather conditions

The major challenge independent rural producers faced after having left the realm of the *barraca* economy was the reorganization of the agro-extractive cycle (Table 1).

Table 1: Agro-extractive cycle in northern Bolivia in the 1990s



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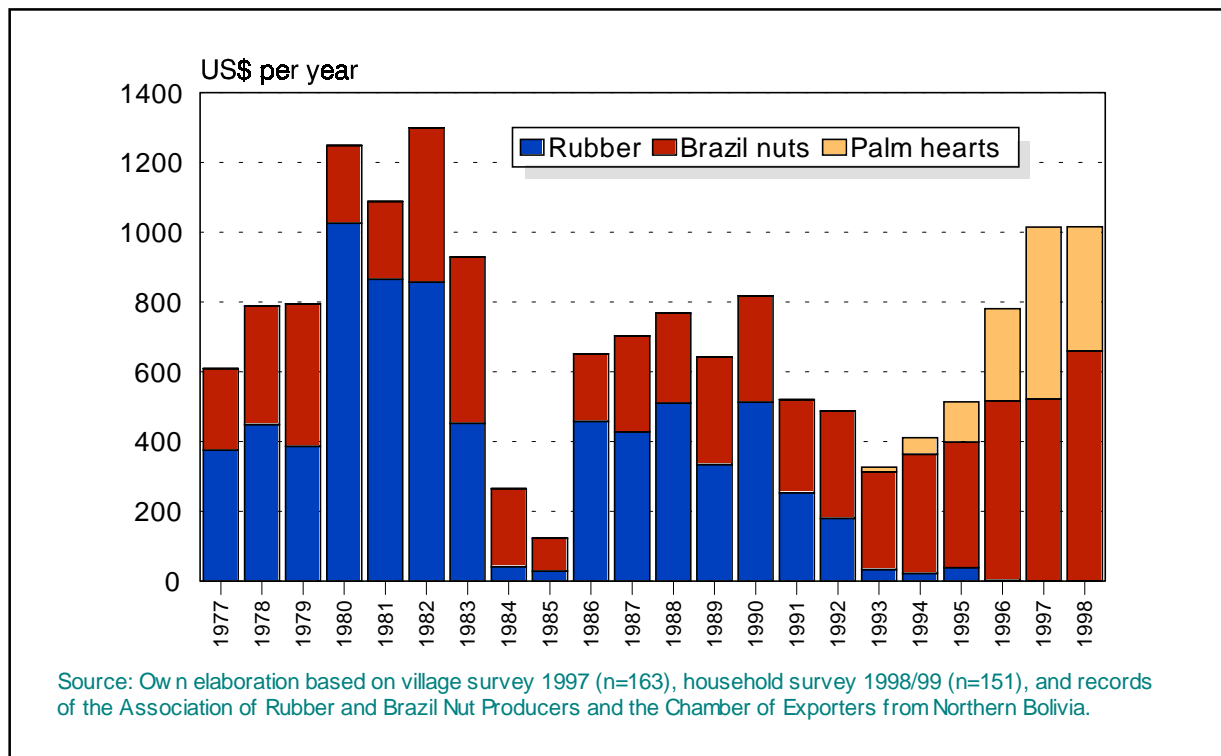
	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
<b><u>Forest products</u></b>												
<b>Brazil nuts</b>						E	E	E	E			
<b>Rubber (until 1992)</b>			E	E	E					E	E	E
<b>Palm hearts (since 1992)</b>	E	E	E	E	E					E	E	E
<b>Timber (since 1985)</b>	(E)	(E)	(E)	(E)	(E)					(E)	(E)	(E)
<b>Fuelwood</b>	E	E	E	E	E	E	E	E	E	E	E	E
<b>Fish and game</b>	E	E	E	E	E	E	E	E	E	E	E	E
<b><u>Agricultural crops</u></b>												
<b>Rice / Maize</b>	SL/B	SL/B	SL/B	S	S	S		H	H	H		
<b>Manioc</b>	H	H	H	S, H	S, H	H	H	H	H	S, H	S, H	H
<b>Plantain</b>	H	H	H	S, H	S, H	H	H	H	H	H	H	H
<b><u>Rainfall (mm)</u></b>	20	22	65	149	196	272	282	259	248	164	76	27

Note: E = Extraction; SL/B = Slash and Burn; H = Harvest; S = Sowing;

With rubber tapping having ceased as the main dry season activity, the vast majority of the rural population turned to the extraction of palm hearts and timber. The agricultural calendar, on the other hand, remained unaltered and one of the peaks in demand for agricultural labor still coincides with the Brazil nut harvest. Fuelwood is extracted throughout the year, but only a tiny portion enters the market. Hunting and fishing are further year-round activities, though fishing is a lot easier during the drier months when water tables are low. In contrast, hunting is more successful around the peak of the rainy season when forest animals concentrate on forest islands not affected by flooding. The alteration of the agro-extractive cycle not only left its traces in labor allocation but also as regards income portfolios (Figure 4).



Figure 4: Average income of rural households in northern Bolivia derived from rubber, Brazil nuts, and palm hearts between 1977 and 1998



In the early 1980s extraction-based income was highest in northern Bolivia. The second oil shock had led to a significant rise in prices of natural rubber that also boosted demand for native rubber from the Amazon. In those years, extraction-based income exceeded the threshold of US\$ 1,000 per year. In 1984 and 1985, however, extractor populations were deprived from their main source of income as Bolivia was hit by an economic and monetary crisis. Hyperinflation was so severe that many estate owners could no longer maintain the steady flow of basic necessities to the *barracas*. With the rubber tappers thus being *de facto* expelled from the *barracas*, rubber-based income dropped to a historical low. At the same time, the slush international market for Brazil nuts provided hardly any alternative for extraction-based income.

But Bolivia recovered from the economic crisis after the government had announced a New Economic Policy in late 1985. The rubber market thus experienced a short-lived revival but, as emphasized earlier, the 1986 abrogation of Brazilian rubber subsidies brought about the demise of rubber by the early 1990s. Fortunately the new policy had provided the framework for export liberalization and incentives were given to establish new firms in the export sector. Northern Bolivia thus saw an impressive expansion of the Brazil nut industry in the second half of the 1980s and the rapid rise of the palm heart industry in the 1990s. The boom in both industries is reflected in increasing rural income generated through the extraction of these two NTFPs. Progressively lower income from rubber tapping could therefore largely be offset by increased earnings from the extraction of Brazil nuts and palm hearts.

## Discussion

The case of the northern Bolivian Amazon where, in the course of time, a variety of NTFPs has been extracted shows that NTFP markets are relatively volatile. Boom-and-bust cycles are not only characteristic for NTFPs suffering from predatory extraction, like hides and skins of forest animals, but also for products whose extraction is considered ecologically sound, such as native rubber or Brazil nuts (cf. Homma, 1992). None of the production systems related to these NTFPs would thus deserve to be labeled 'sustainable', if focusing on a specific product alone. Instead, it is suggested to adopt a livelihood perspective when evaluating ecological soundness, economic viability, and social acceptance of NTFP production systems. As NTFPs are embedded in diverse livelihood strategies that are constantly adjusted to change, it is necessary to acquire a more dynamic view of sustainability. Only when accounting for the temporal and spatial variations of such strategies it is possible to adequately evaluate their performance.

In northern Bolivia, thousands of rural households have succeeded in making their living from forest product extraction and (subsistence) agriculture over the past 150 years. The general pattern was that periods of low demand for given NTFPs were bridged by the expansion of agriculture paired with the search of alternative forest products for sale. In contrast, boom periods of specific forest products prompted the rural population to redirect labor from agriculture to forest product extraction. In these periods, food insecurity posed a risk to the self-sufficiency of rural households, forcing them to invest part of their NTFP-based income in the purchase of foodstuffs (cf. Romanoff, 1992). Contraction and expansion of both agricultural and extractive activities thus emanated as key features of rural livelihood systems.

In addition to temporal variations, livelihood strategies in northern Bolivia vary over space. In settlements remote from (urban) markets, agriculture is mainly for subsistence while forest product extraction makes up the chief source of income. Closer to town, land scarcity is a more serious problem, forest cover diminishes, and agriculture becomes increasingly directed to the market. In these settlements, forest products generate only marginal income, unless their inhabitants seasonally migrate to a *barraca* to participate in the extraction of Brazil nuts, palm hearts, or timber. Besides, large farms and cattle ranches situated in the vicinity of town provide opportunities for agricultural wage labor. Rural dwellers in the immediate surroundings of town even have access to the urban labor market and therefore derive part of their income from wage labor. Agriculture may be an equally important source of income but the potential of forest product extraction from the own territory is very limited.

## Conclusions

Extraction-based livelihood strategies are a viable option for rural dwellers in tropical forest areas when extractor populations succeed to adjust to changes imposed by the fluctuation of (international) demand on NTFP markets. The rural population of the northern Bolivian Amazon has successfully balanced the trade-offs between forest product extraction, agriculture, and wage labor over more than a century. Notwithstanding the overexploitation of given forest products and the increased conversion of high forest into arable and pasture in urban surroundings, the region's forests are in an excellent state of preservation. However, to be viable in the mid and long run, rural livelihoods need to meet the following requirements:

- self-sufficiency in food production (through seed improvement, diversified cropping patterns, and, generally, adoption of more sophisticated agroforestry techniques)

- diversification of both non-timber forest products and markets (sale of a variety of products on local, regional, and international markets)
- residential mobility (seasonal migration to areas of higher demand for labor)

While most of these requirements can be met by rural households alone, it is indispensable that both governmental and non-governmental organizations contribute their part to render extraction-based livelihood strategies successful. First, rural services, such as transportation, schooling, and health care need to be improved. Massive out-migration from settlements lacking such services reflects the rural population's strive to surpass the harsh living conditions in remote settlements deprived of these facilities. Second, rural extension needs to focus on the sophistication of agroforestry techniques that are by no means as diverse as those known from other parts of the Amazon. Finally, the banking sector and NGOs are called upon to negotiate about innovative credit programs for small producers in rural areas who, for the time being, are left without access to small credits.

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