

Collective boundaries and forest dependency in the western highlands of Guatemala

J. P. Prado Córdoba¹, S. E. Gramajo², S. Wunder³, C. Smith Olsen⁴

Abstract

A socio-economic survey across the Guatemalan western highlands provides our foundation for exploring the functioning of communal management regimes in varying contexts of forest dependency. Our analysis is intended to shed light on the management rationale underlying the use of forest resources, and its relation to local livelihoods, with emphasis on land tenure and local empowerment. An in-depth survey was carried out across 12 villages in three townships where different ways of interaction among individually owned plots, communal forest and labour were found. Our assessment suggests that one village's attempt to obtain a registered land title for a communal forest area catalysed frictions with the surrounding villages, as the rest of the user groups considered it an exclusion from the commons. Their concern stemmed mainly from the widespread awareness about the importance of preserving these forest lands for ecological services such as protection against landslides in a predominantly steep landscape, and hydrological regulation; and their determination to preserve their hitherto communal land regime at a coarse scale. Furthermore, our survey indicates that the village in question was the poorest one in our sample, thereby implying an association between welfare and social cohesion. These preliminary findings add to the current debate about local livelihoods strategies in a context of common pool resources.

Key words

A. guatemalensis, common pool resources, forest income, Guatemala, indigenous peoples, livelihoods, social cohesion

Introduction

Subsistence farmers in the tropics and sub-tropics provide societies with important services such as cultivation and conservation of rare plant genetic resources, and in so doing they contribute to maintaining the global diversity of crop species (Isakson, 2007). Small-scale agriculturalists, such as those living in mountainous regions, play a significant role in managing their natural environment, which, in turn, is indispensable for maintaining biodiversity and supply of drinking water, reducing risks of landslides, and providing downstream settlements with cultural, recreational and amenity values (World Bank, 2002). At the same time, often these rural dwellers

¹ Faculty of Agronomy, University of San Carlos of Guatemala, Ciudad Universitaria, Zona 12, 01012, Ciudad de Guatemala, Guatemala. Corresponding author (e-mail: p Prado@usac.edu.gt; Fax: +502 24767737)

² Faculty of Agronomy, University of San Carlos of Guatemala, Ciudad Universitaria, Zona 12, 01012, Ciudad de Guatemala, Guatemala

³ Center for International Forestry Research, Belem, Brazil

⁴ Danish Centre for Forest, Landscape and Planning, University of Copenhagen, Rolighedsvej 23, 1958 Frederiksberg, Denmark

are subjected to considerable hardship and eroded livelihoods. The western highlands of Guatemala are mostly populated by small-scale farmers with little income (PNUD 2005; Vakis 2003), where the notion of what today is referred as 'conservation by utilisation' actually has a long tradition back to pre-Hispanic times, when agricultural and forest exploitation practices were carried out bearing in mind the conservation status of forest lands (Veblen, 1978). Yet the links between these subsistence practices and the surrounding forest ecosystems have often been neglected in the scientific literature, despite the number of goods and services generally obtained at the household level. The outcome from such an interface has been referred to as 'co-production', i.e. the interaction between peasants and their natural environment (Gerritsen and Wiersum, 2005; Gerritsen and Van der Ploeg, 2006), which constitutes a rationale often built on locally devised livelihoods strategies. These strategies often contrast with mainstream conservation practice (e.g. Salafsky and Wollenberg, 2000), that tends to deem small-scale agriculture as a threat for biodiversity conservation (Sanderson, 2005), thereby underestimating the multidimensional nature of local livelihoods strategies and the diversity of coping systems (Nygren, 2000).

Given the local socioeconomic vulnerability, the linkages between peasant income generating activities and the associated land husbandry practices deserve more attention when addressing the interface between biodiversity conservation and rural development, above all, in those contexts where land is administered under ancestral communal schemes. Several studies in southern Mexico have shed light on the need to promote alternative development and conservation practices consistent with a balanced interchange between peasant communities rationale and ecological resilience (Gerritsen *et al.* 2003; Figueroa *et al.* 2005; Gerritsen and Wiersum 2005; Gerritsen and Van der Ploeg 2006). In this sense, the epistemological development of industrial agriculture and forestry has tended to fracture interdependency between society and nature over time (Mardsen *et al.* 2001; Scott, 1998) in contexts where local processes are increasingly dependant on external forces, notably economic transactions (Nygren, 2000). That is to say that those feasible strategies for sustainable rural development can not be understood independent of international flows of capital and the associated political decisions. However, market-based strategies have rendered a wide spectrum of results when used for conservation purposes (Zerner, 2000: 3-5), and the aforementioned balanced scenario between peasant practices and biological conservation presupposes an integration between people and nature (Folke, 2005), which brings about reliable long lasting livelihoods strategies.

One of the most conspicuous features in the interaction between small-scale farming systems and their surrounding natural environment is the share of total income, i.e. both cash and subsistence, generated by extracting forest products. This spells out the nature of the forest dependency scenario, which has typically been classified as functioning as an insurance (safety net), consumption support (gap filling, regular subsistence uses and low-return cash activities), and poverty reduction vehicle (forest based income generation and environmental payments) (Vedeld *et al.*, 2004).

This paper aims to estimate total income of households in communal management contexts and to understand the degree of forest dependency of communities in the natural distribution area of *Abies guatemalensis* Rehder, a vulnerable conifer from the upper montane forests of Guatemala. Extinction risk of this species is due to unsustainable harvest of branches for Christmas decorations

and sheep grazing (López *et al.* 1999; Strandby Andersen *et al.* 2006). Therefore, it is necessary to investigate to what extent these communities depend on forest products and to assess whether or not they would be negatively affected by forest fragmentation and further depletion of the associated natural resources in order to improve both our study species conservation status and its potential to strengthen local economies and communal land use arrangements.

Background

Township-based forest regimes and communal management schemes account for 23 % of forest lands in Guatemala (Larsson *et al.*, 2006). The western highlands provide the backdrop for a number of communal schemes often associated with the conservation and utilisation of forest lands. This region spans over approximately 30% of the national territory and is characterised by an abundant history of collective action strategies around land tenure issues (Katz, 2000). In fact, local dwellers have been historically exposed to invasion and subjugation, and even so remain strongly attached to their land, community and territory (Lovell, 1988). Broadly speaking, six types of tenure regimes are to be found in this area, namely: (i) private, (ii) *parcialidad* (owned by extended kin groups), (iii) communal, (iv) municipal-communal, (v) municipal, and (vi) national (Utting, 1993 cited by Reddy, 2002).

Indigenous peoples have established functional resource use patterns on the grounds of their cultural practices (Veblen, 1978), their level of articulation with the market economy (Isakson, 2007), and a fragile political environment under conditions of rural exclusion (Krznaric, 2005; Lovell, 2003). However, empirical evidence suggests that this functionality largely depends on the enforcement of locally agreed upon rules and regulations (Katz, 2000), which often entail an alternative institutional arrangement that is not necessarily included in centrally devised national frameworks. Such a scenario leads to local vulnerability for common pool management regimes as market driven policies such as cadastral surveys, often inspired on a persistently particular interpretation of 'the tragedy of the commons', usually encourage a process of individualisation of collectively owned forest lands, thereby bringing about social conflicts among those committed to preserving the commons and those willing to privatise their individual parcels, i.e. a social dilemma (Ostrom, 1998), as the overall outcome is not considered to be the optimal one by all parties involved. These dilemmas stem from a number of circumstances such as unsolved disputes over territories and boundaries, and discrepancies between local councils and centralised government agencies on how these lands should be administered, as well as overlaps between *de jure* municipal property rights and *de facto* rights exercised by local communities (Reddy, 2002; Shlager and Ostrom, 1992).

Rational choice theory suggests that this scenario entails a Pareto-inferior equilibrium and therefore solving a social dilemma is all about moving to a closer situation to the optimum (Ostrom, 1998). That is, new scenarios where the resulting outcomes make all members of that particular society better off by means of constraining the maximisation of individual gains by institutions (Reddy, 2002). In this sense, the very nature of institutions turns out to be crucial as the theoretical foundations for assuming 'rational' economic behaviour do not necessarily apply in non-western scenarios (Lander, 2005) where reciprocity and collective actions are deeply rooted in society as cultural constructs. Consequently, the pursuit of a Pareto-

optimal scenario seems to be driven by mainstream conservation discourse and local capabilities for land conflict resolution and management. Nonetheless, even under optimal conditions, sound communal schemes may fail in bringing about welfare insofar as conservation goals keep favouring 'charismatic' species and habitats instead of those *taxa* whose viability renders crucial outcomes for local livelihoods (Kaimowitz & Shell, 2007), thereby paving the way for international aid agendas at the expense of local changes in the ways to manage natural resources, that is to say a conflicting situation where the alleged globally greater good exerts a significant burden on the local one. Hence, the challenge seems to be where to draw the line between both. Such a complexity is in line with how cooperative schemes are not necessarily 'Nash-equilibrium' points, and therefore turn out to be unstable under a number of circumstances, notably cultural practices in place (Holt & Roth, 2004).

Political theorisation of common pool institutions offers a good ground to address the complexities of power distribution and social dilemmas. From this theoretical perspective, common pool institutions are considered as political agents in the landscape actively involved in local struggles to keep control over resources and territories (Reddy, 2002). In addition, from an evolutionary dynamics perspective, often the commons entail a three-way strategies problem, that is to say that three groups tend to arise, namely (i) *defectors*; (ii) *co-operators*; and (iii) *enforcers*. The possible share combinations of these three strategies bring about different 'Nash equilibrium' points at differentiated ecological thresholds. In fact, sanctions need to be hard enough to deter those inclined to defect, thereby encouraging restraining attitudes and improving use practices leading to ecological resilience (Sethi and Somanathan, 1996).

Methods

Sites

Twelve representative villages were selected in the highlands of Guatemala (2567–3580 m a.s.l.) in the proximity of remnant forests with *A. guatemalensis*. This endangered species was the main criterion given the ecological approach of the research project, whose aim was to improve the conservation status of this tree while bringing about novel income sources for the local villages. Logistic conditions were decisive as to defining research sites, which were drawn from three townships, namely *Totonicapán*, *Cabricán* and *Todos Santos Cuchumatán*.

Totonicapán

In pre-Hispanic *Totonicapán* maize was the predominant crop, even more than today, although agricultural activity above 2750 m a.s.l., was less frequent. At this time, local agriculturalist probably relied more on forest litter and crop residue for fertilising in the absence of alternative sources such as animal manure and chemicals. Tree felling is not likely to have intensely occurred at the time, as the typical house was built of adobe and grass. On the other hand, historical evidence suggests that bark from white pines was exploited as a source of tannin and clothing. Consequently, the pre-Hispanic *K'iche'* people valued their forest resources primarily as a source of fuel and fertiliser and secondarily as a source of minor extractive products (Veblen, 1978). The aftermath of the conquest by the Spaniards entailed a number of transformations as regard to the ways in which indigenous peoples in this area used to interact with their territories. They were basically cornered to live within certain limits thereby making it easy for the invaders to oversee enslaved labour.

Cabricán

Cabricán was populated following a scattered pattern of housing during the Pre-Hispanic period. The *Mam* people first appeared during the Post-Classic, and were eventually subjugated by the hegemony of the *K'iche'*. Agriculture is the main economic activity and family clans –easily spotted through family names, are commonplace. From *Mam* people's understanding of the world both forests and lakes are sacred, as they are deemed as the domains of the *Tajaw Witz* (landlord of the wilderness), an enigmatic character not always visible to all, and sometimes associated with a large snake or a human figure of European features. Forests (*toj k'ul*) also play a major role for the local economies, mainly as reservoirs of organic matter to be used as fertiliser for the production of potatoes, vegetables and maize. Litter is obtained mainly from broadleaf species. This region has become specialized in the production of lime, an intense firewood consuming activity, thereby bringing about serious problems of deforestation. The Guatemalan fir (*A. guatemalensis*), locally known as *Pajtxaq* is traditionally used as an ornament during weddings and for religious rituals about rain pleas and gratitude for the harvest, and for the elaboration of festoons during Easter. This species is deemed as sacred and is used for firewood, coal, furniture elaboration, construction, and weaving. Litter from this tree is not highly appreciated as its quality is not as good as that of other species (Hostnig *et al.*, 1998).

Todos Santos Cuchumatán

The arrival of the Spaniards in the mountains of *Huehuetenango* entailed a profound changeover as to the ways in which the locals harnessed their natural resources base. In fact, the whole process comprised three stages, namely: (i) warfare; (ii) territories encroachment; and (iii) ideological conquest by means of the evangelisation process. *Huehuetenango* offered resistance to the invasion. The Spanish army had to siege the fortress of *Zaculeu* for nearly a month, and generally speaking the whole conquest was rather brutal (Castañeda, 1998). Upon the establishment of the first *encomendero* (Spanish landlord bestowed upon with the mission of Christianisation, protection and tax collection from the indigenous population) in 1525, new economic activities appeared such as cattle rising, carpentry and blacksmithing. This brought about the *hacienda* as the predominant production unit based on indigenous labour subjugated by the conquerors (Tejada B., 2002). Even though some silver deposits were to be found in this area, the whole country could not compete with the richness found down South, and that is the reason way the economic rationale of the conquest relied on maximising the surplus obtained from the enslaved indigenous population and the availability of fertile land. Villages locations are shown in Figure 1.

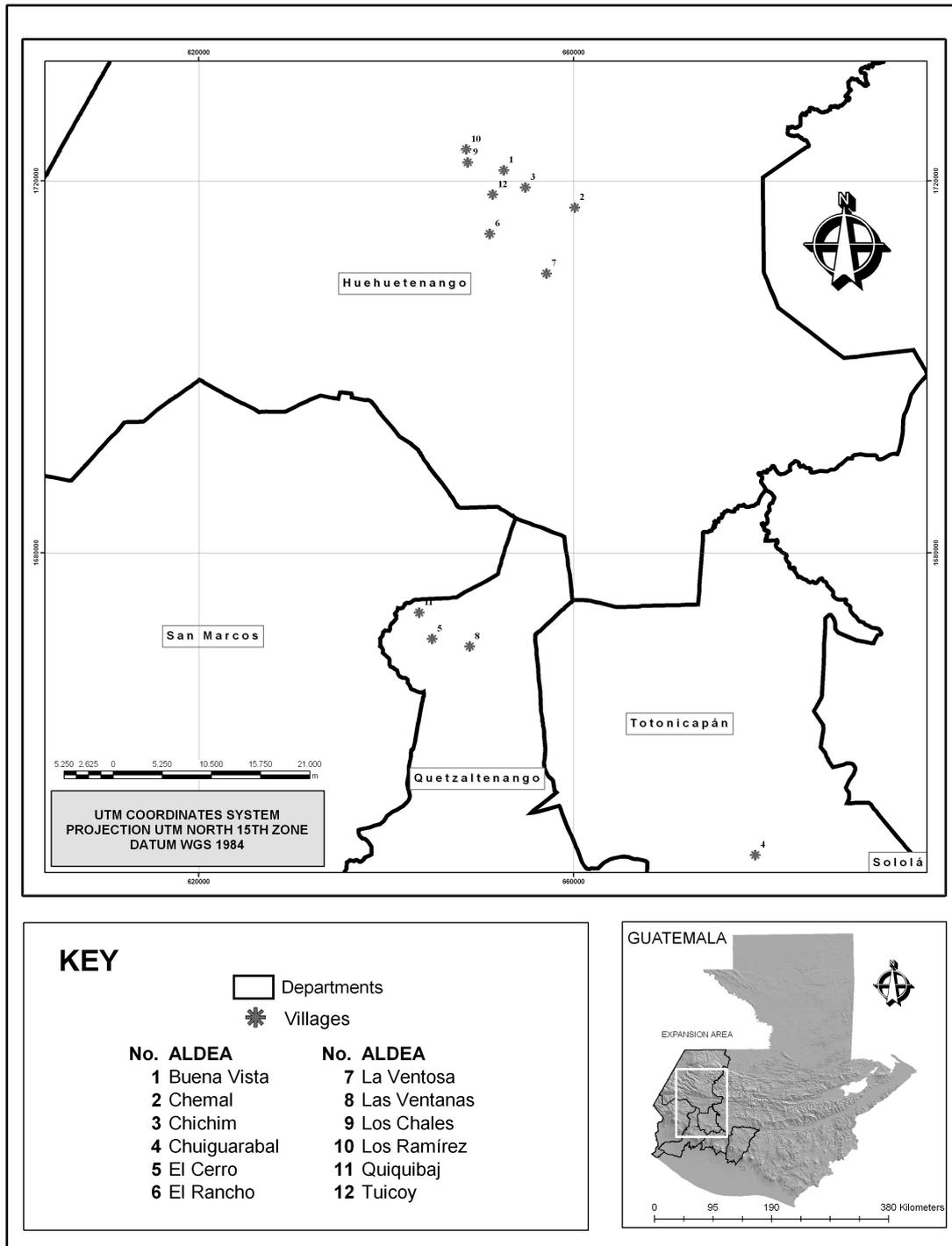


Figure 1. Villages location across the western highlands of Guatemala

Sampling

A theoretical random sample size ($P = 0.5$, $\alpha = 0.95$, $S.E. = 0.05$) following the non-probabilistic intentional sampling technique (Hernández *et al.*, 2001) was further reduced in light of a realistic estimate of available resources in the study region. The final field sample size was defined on the grounds of the willingness of the villages' members to participate in the interviews and meetings, which was explored by consulting local authorities and communities' leaders; and the existence of on-going initiatives carried out by local organisations in regard to our case study species.

Therefore, these analyses are representative for households relatively close to *A. guatemalensis* forests, and not necessarily for other parts of the townships, notably in *Totonicapán*.

Data collection approach

One USAC BSc student was appointed at each township in order to monitor and supervise local enumerators in the use of questionnaires and interviewing standard procedures. The questionnaires were prepared following the general templates proposed by the CIFOR-Poverty and Environment Network (PEN⁵). In order to capture seasonality effects selected households were visited on a quarterly basis until four visits were completed across the period February–December 2006, with three, and exceptionally four (Q3), months recall periods as shown in Table 1. Notably, a whole quarter is missing for the township of *Totonicapán*, which could not be completed due to local upheaval leading to the temporary imprisonment of the local most prominent leaders.

Table 1. Site characteristics and survey rounds frequency

Townships	Village names	Village codes	Altitude (m)	Rainfall (mm)	Theoretical sample size	Field sample size Q1 Nov06-Jan07	Field sample size Q2 Feb07-Apr07	Field sample size Q3 May07-Aug07	Field sample size Q4 Sep07-Nov07
<i>Totonicapán</i>	<i>Chuiguarabal</i>	11	2900	1450	13	43	0	26	25
	<i>Cabricán</i>	21	2700	1013	66	34	36	36	34
	Las Ventanas	22	2567	1000	68	34	25	28	20
	Quiquibaj	23	2657	1000	24	12	12	9	11
<i>Todos Santos</i>	El Rancho	31	2800	2300	22	16	16	15	16
	La Ventosa	32	3200	1500	18	10	10	10	10
<i>Cuchumatán</i>	Chichim	33	3600	2000	16	11	10	11	11
	Los Ramírez	34	2800	2000	11	6	5	4	5
	Buena Vista	35	3530	2000	9	7	7	7	7
	Chemal	36	3580	1800	12	5	5	5	4
	Tuicoy	37	3200	1800	5	5	3	0	4
	Los Chales ⁶	38	2600	2000	7	7	4	0	0
Total					271	190	133	151	147

Data analyses

Aggregate income estimates were calculated by using local mean prices obtained from primary data collected during the interviews. Given the diversity of livelihoods strategies, assets, respondents, enumerators and seasons each source of income was treated separately as shown in Appendix 1. Mean prices were used to estimate general aggregates of cash and subsistence income at the township groupings level in order to analyse those local trends, given the varying composition of livelihoods strategies (Appendices 2-4). Forest-related incomes were extracted from the general data base and income shares for each category were calculated by estimating percentages of total income.

Results

Income

Total income was found to be diverse across the households visited but mainly based on wage, forest-related income, small-scale agriculture and remittances as shown in Figure 2. The most prominent outlier is cash income in *Todos Santos*

⁵ These templates can be consulted at www.cifor.cgiar.org/pen

⁶ This village had to be discarded as widespread mistrust made it risky to keep conducting our survey.

Cuchumatán, mainly explained by the commercial cultivation of potatoes, and the main costs are related to agricultural inputs.

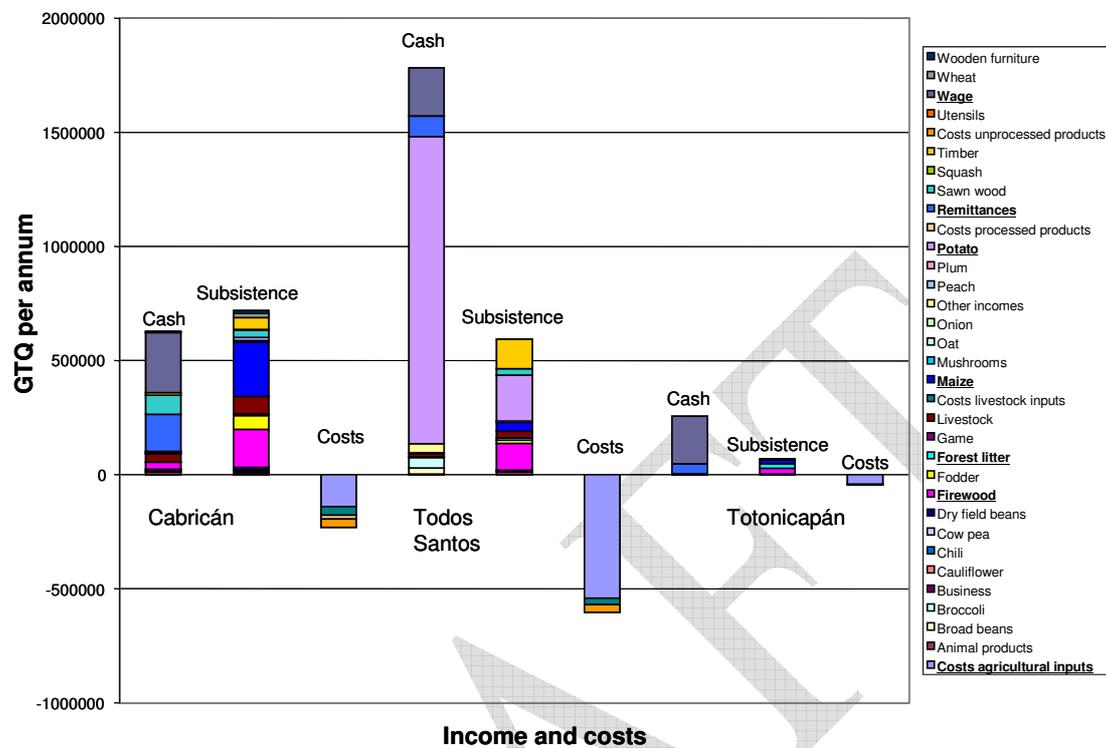


Figure 2. Overall costs and types of income

Cash income

A decreasing continuum of wage importance was observed across the three townships, with a high share of cash income in Tonicapán (81%), going further down gradually for *Cabricán* (42%) and *Todos Santos Cuchumatán* (12%). Small-scale agriculture is predominant as to wage sources, followed by manufacturing, construction work and education. Wage sources vary as shown in Figure 3.

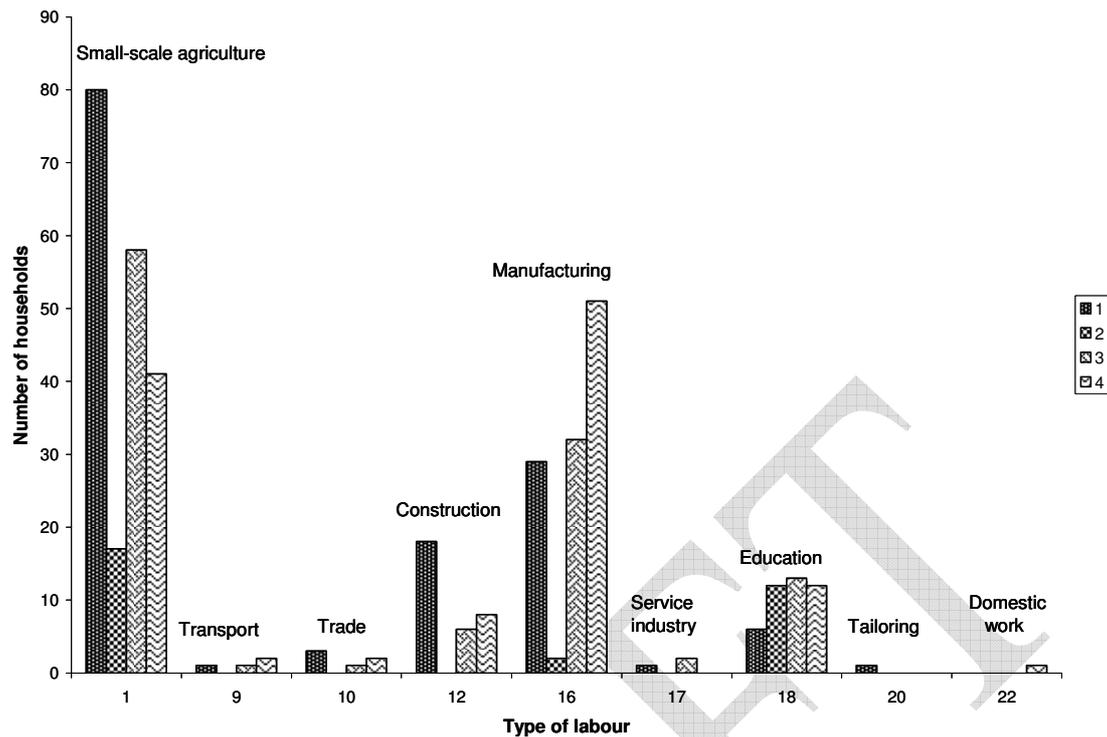


Figure 3. Wage composition by quarters

This wage composition shed light on the overall importance of small-scale agriculture in the study sites, which provides both direct benefits through harvesting and a significant share of employment. Furthermore, the case of *Todos Santos Cuchumatán* stands out with regard to the main cash income source. In this township potato alone accounts for the greatest part of cash income (75.4%), outweighing by far the rest of the cash sources. *Cabricán* turned out to be significantly dependant on remittances for cash income (25.8%), and this influx from abroad was found to be the second largest cash income source for Totonicapán (16.8%) and the third for *Todos Santos Cuchumatán* (5.1%). This is consistent with the increasing outflow of Guatemalan workers migrating to the USA in search for better working opportunities. However, Dardón (2004) warns about the potential negative consequences associated with localised economic growth that does not activate local markets, thereby weakening economic stability and access to welfare in the long run. De Haas (2005) counter argues this perception by questioning the existing empirical basis for disregarding remittances as an activator of domestic economies, but acknowledges that the extent to which migration and remittances can bring about development ultimately depends on the specific political, economic, and social circumstances in both sending and receiving countries. What seems clear is that the interdependence between international migration and development plays an increasingly major role in the study areas.

Leading emigrating countries are typically not to be found amongst the least developed ones, as certain level of socioeconomic development seems to be a precondition for international migration (De Haas, 2005). In principle, the study sites yielded slightly different results, as the poorest township groupings, that is, *Cabricán* and Totonicapán are more heavily dependant on remittances for cash income (25.8 % and 16.8%, respectively) than the less poor *Todos Santos Cuchumatán* (5.1%),

albeit if looked at in the framework of this analysis, the poorest township, i.e. Tonicapán is less dependant on remittances than the slightly wealthier *Cabricán*, confirming international trends.

Subsistence income

Subsistence income sources provided good evidence of forest dependency in these peasant communities. In Tonicapán, forest-related products accounted for 70.4% of subsistence income followed by maize with 24.4%. *Cabricán* yielded values of 45.4% and 33.1% for the same couple of products, and *Todos Santos Cuchumatán* kept the pattern with values of 50.3% for forest-related products and 34.0% for potatoes. Figure 4 shows how this pattern is related with both cash and total income.

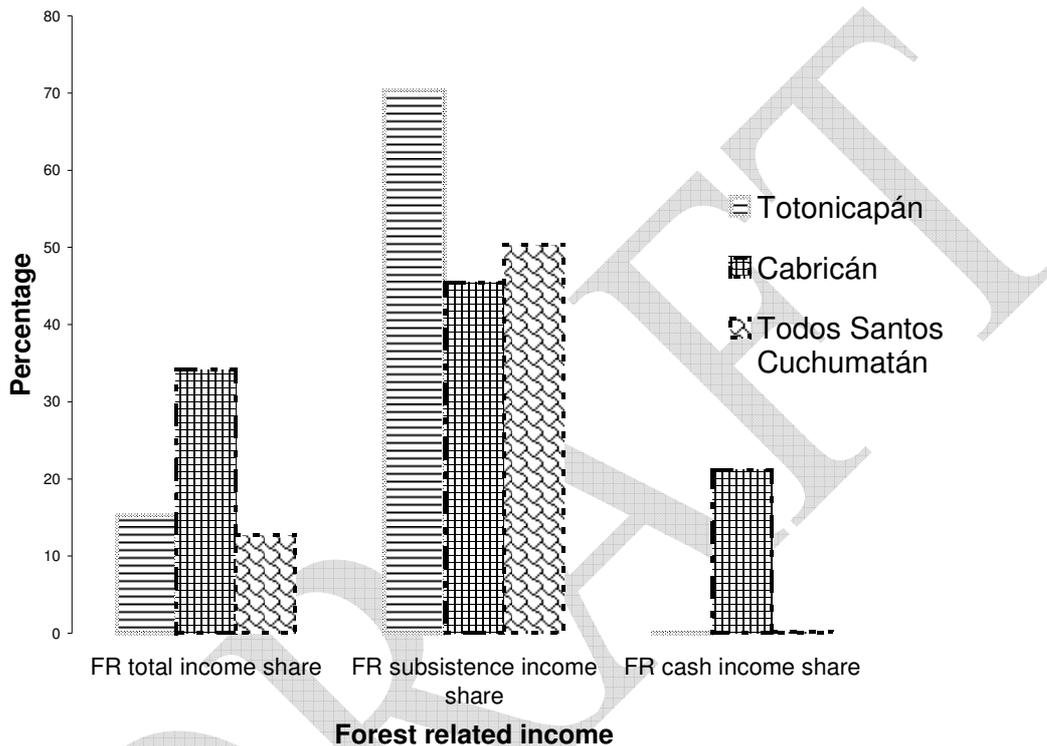


Figure 4. Forest-related income shares in the three study townships

These figures help to understand the role of forest products in peasant economies in the study areas, and they are consistent with what has been suggested by other authors about the share values from forest-related products in poor rural environments (Arnold *et al.* 2003; Vedeld *et al.* 2004). When analysing the direct role of forests in these household livelihoods strategies, evidence suggests that given the high share of forest-related income in subsistence, these scenarios fall into the category of 'regular subsistence uses' suggested by Vedeld *et al.* (2004), above all, in terms of firewood and forest litter consumption. The former guarantee energy supply, whereas the latter is widely used as a natural fertiliser in the field, making it obvious the mutual interdependence between these peasant systems and their surrounding forest environment. Nonetheless, such a co-production process seems not to have reached a stable phase yet. Even though these figures represent coarse estimates at the township grouping level, net income aggregates may give an idea of the current levels of rural poverty in those areas. In fact, when compared with those data generated at the township level by the United Nations (PNUD, 2005), only *Todos Santos Cuchumatán* is slightly above the poverty line threshold, notably due

to potato cultivation, which entails serious risks as any other single-based dependent regional economy.

Chuiguarabal: Partitioning the commons

The hamlet of *Chuiguarabal* consists of 249 dwellers of the ethnic group *K'iche'* spread across an area of 313.367 ha, yielding a population density of 79 inhabitants/Km². The 44 households in town were found to have between 2 and 11 members. Most of them (77%) had four members or more. All in all, 47% of the population is female and 53% is male. 75 % of the population is under 31 years of age, following national trends. There is no school in town, which brings about an illiteracy rate of 41%; as for the remainder of them, varying degrees of schooling were found, with predominance (14%) of those with six years of school attendance.

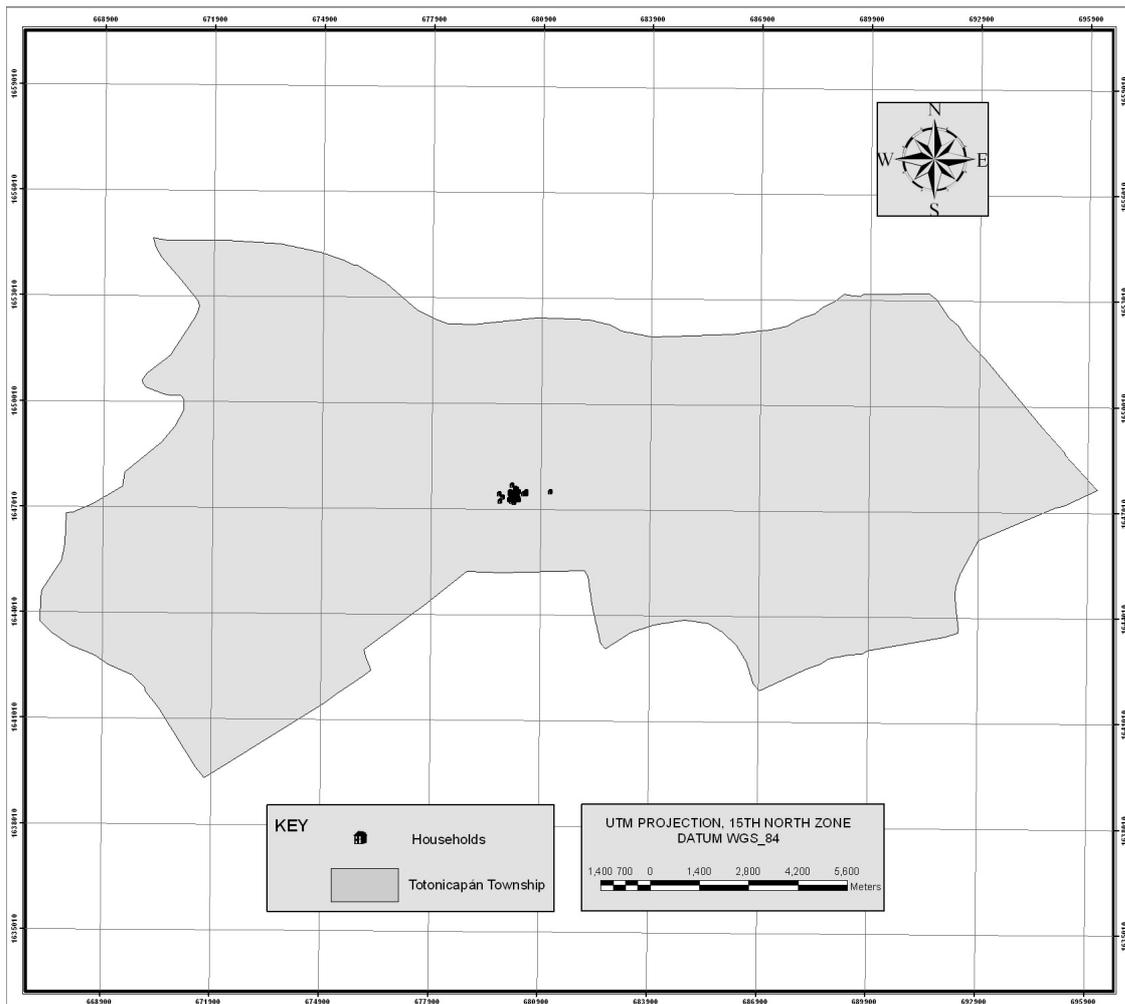


Figure 5. Location of the hamlet Chuiguarabal within the township of Tonicapán

It was first established in the late 18th century by those making the journey from the western highlands to the capital city. Ever since its establishment this hamlet has been deemed as part of a larger administrative unit, the village of *Panquix*, through which it is represented at the '48 villages' council. This organisation promotes the collective administration of a significant forest state where strict surveillance takes place. Land cover has been categorised as depicted in Table 2.

Table 2. Land cover categories in Chuiguarabal

Land cover	Area (Hectares)	Percentage
Sparse pine forest	43.396	13.85

Dense pine forest	36.758	11.73
Fir stands	51.822	16.54
Dense fir and pine forest	40.771	13.01
Dense pine and fir forest	38.308	12.23
Sparse broadleaf and pine forest	12.162	3.88
Agriculture	77.093	24.61
Housing	13.000	4.15
Total	313.31	100.00

Notwithstanding the collective benefits brought about by this setting, *Chuiguarabal* dwellers opted to start off a legal procedure to be excluded from the commons along with their 313.31 hectares of land. This brought about a full rejection by the rest of the nearby villages leading to the temporal imprisonment of the leaders of the 'separatists' –on the grounds of an allegedly unauthorised forest clearance, who have been seen as trespassers by those who had previously arrived in this area. The clearance in question turned out to be a locally agreed upon forest intervention. These events suggest that collective action in the area might have been lacking equity towards this small hamlet, thereby rendering differentiated shares of goods and services across communities and socioeconomic strata. In fact, scholarly research has not always found collective action to properly address equity issues at local scales (Adhikari et al., 2004). Recent events in this community confirmed the prevalence of a conflictive scenario as on 20th February 2008 roundabout 250 dwellers from a nearby village entered the woods around *Chuiguarabal* carrying 5 chainsaws with the intention of felling 3 trees. This episode is deemed by the leaders of *Chuiguarabal* as a warning signal. In fact, the 48 *Cantones* council has sent them a written statement where their very presence in those lands is regarded as a trespassing act; thereby eviction actions have been suggested (M. García, pers. comm.).

What makes this particular case highly complex is the underlying rationale by which a segment of the large community has one-sidedly decided to 'leave' the commons by means of collectively (45 households) privatising nearly 300 ha of forest lands. Furthermore, these actions have been undertaken through the national legal system, which means that customary procedures were neglected. This is one of the major sources of opposition from the nearby villages. Even if *Chuiguarabal* can legitimately claim to be entitled to have started off this process, the fact is that in so doing, the larger commons are being fragmented. So, to what extent communal property should be maintained in this context? Is it collective fragmentation an unbearable threat to the commons? The answers for these questions depend on the scale communal property –be it *de jure* or *de facto*, is being analysed. At a coarse scale, this sort of fragmentation certainly threatens the commons integrity as this separatist action might inspire others to do the same in a context where land market driven policies encourage formalisation of property rights on an individual basis. The complex web of social, economic and power interactions underlying common property regimes turns out to be too entangled for market mechanisms to incorporate; thereby grids of simplification are normally suggested and even enforced where legal frameworks allow for this sort of approach. On the other hand, i.e. at a finer scale, these events clearly entail a hindrance for a full appropriation of the surrounding territory inasmuch as even those dwelling there are excluded from the local power exercise in relation to these forest lands. The only foreseeable way

out for *Chuiguarabal* seems to be to exercise their customary rights and seek for a solution without jeopardising the commons integrity at the coarse scale. This would imply to decline their claims at the national judicial system and transfer them to the customary realm. In this sense, it can be argued that a clash of citizenships is taking place, where westernised national frameworks have not yet merged with customary locally rooted ones.

Discussion

Subsistence and conservation

These case studies shed light on the interactions between subsistence strategies and ecosystems resilience as extraction rates should be kept to sustainable levels in order to guarantee availability in the long run. This rationale has in fact been followed over the centuries in the western highlands of Guatemala (Veblen, 1978) in a sense where pristine areas have not been the main target, but an extractive rationale that values subsistence resources and therefore respects their resilience thresholds. Our study species serves as an example of how an emblematic tree highly regarded by mainstream conservation discourse is locally considered as a marginal component of the livelihood strategies in terms of its direct benefits. However, the ecological integrity of the surrounding habitat allows for more relevant subsistence practices such as the extraction of forest litter and fuel wood. This is notably true for the poorest village in our sample, where economic constraints limit substantially the purchase power of small-scale farmers who have to offset the lack of inputs with forest products acting as substitutes. Our ecological analyses (Kollmann *et al.*, in press) indicate that forest litter removal may increase seedling survival for *A. guatemalensis*, which would maintain the flux of natural fertilisers for agricultural plots.

Collective action and welfare

This liaison between subsistence and conservation requires the enforcement of collective rules so that extraction practices are kept to a sustainable level. Forest lands have been looked after in a context of collectively agreed upon rules and regulations whose enforcement possibilities are robust in the study areas, thereby bringing about a steady flux of incentives for a cooperative strategy. Exceptionally, one of the hamlets in the sample opted for a privatisation strategy in order to secure property rights at the expense of fragmenting the greater commons. This behaviour seems to be consistent with mainstream land administration with regard to securing land markets by means of legalising titles so as to stimulate a dynamic commercial exchange of property rights. In fact, neoclassical economists would insist on the need for an efficient allocation of property rights that brings about the best possible scenario where the most competitive economic agents would obtain those rights on the grounds of their alleged best operating capacities. However, it is widely acknowledged that such a scenario would entail at least three negative outcomes for collective welfare, namely: (i) generally certain groups have more access to information, (ii) the concomitant land concentration following the workings of land markets in highly unequal contexts, and (iii) biases towards large landholders whose operation may actually turn out inefficient (Feder, 1999). In *Totonicapán*, the fragmenting strategy followed by *Chuiguarabal* was immediately considered as a defecting strategy by the rest of the villages and consequently a

number of sanctions were implemented. This turn of events shows that collective action in this context is still strong enough to cope with potential defectors, however our income measurements reveal that extreme poverty is common place in the area, which poses a challenging threat to the greater commons integrity. This defecting strategy may have well been followed as a last resource attempt to escape hardship by one of the hamlets where the benefits of being part of the greater commons are elusive or even go completely unnoticed. The other villages in the remainder of the sample showed slightly better socioeconomic indicators and they are fully articulated with their surrounding villages. Therefore, it would be fair to say that all villages cope with hardship scenarios stemming from secular exclusion and exploitation by elites, which have been exacerbated where attempts to partition the commons have been made. That is to say, that even under deprivation scenarios, social cohesion entails some sort of safety net that prevents rural communities to become extremely poor. At the same time, what could be considered as an “irrational” behaviour from the mainstream rural development perspective is actually a resistance strategy by which indigenous peoples advocate for their collective rights to land and territories regardless of their functionality for the land market. In so doing, a significant support for welfare is achieved as this level of organisation do promote social networking and reciprocity, which brings about cooperative and enforcing strategies.

Conclusions

Habitat conservation renders paramount inputs for subsistence strategies across rural villages in the western highlands of Guatemala. Consequently, habitat fragmentation and destruction would eventually jeopardise livelihood strategies exacerbating vulnerabilities, and forcing peasant families to employ last resource actions such as international migration, which weakens social cohesion and therefore leverages habitat degradation by decreasing local capacity for rules enforcement. Forest dependency may serve as a sustainable practice that provides a steady flux of goods and services to rural communities insofar as resilience thresholds are kept. Market incentives encourage commons fragmentation as land administration and survey policies foster land markets where individual property rights are privileged. In this respect, indigenous peoples offer a resistance front to a reductionist approach to land husbandry. They have developed a collective action scheme in the study area that prevents defecting strategies and promotes both social cohesion and ecological conservation. However, current practices such as overgrazing and poaching in the area increasingly erode habitat viability and entail alarm signals for the localised lack of rules enforcement as a consequence of weakened levels of social cohesion.

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Appendix 1. Local prices in GTQ for the main households' assets

Product	Unit	Township	Observations	Mean \pm SD	Range	Median	Mode
<i>Unprocessed products</i>							
Timber	Dozen	Cabricán	12	140 \pm 80	72–300	120	72
Firewood	Head load	Totonicapán	71	26 \pm 8	10–35	30	30
		Cabricán	229	27 \pm 5	10–60	30	30
		Todos Santos	77	37 \pm 10	14–75	40	40
Mushrooms	Pound	Totonicapán	15	10 \pm 1	10–15	10	10
Forest litter	Sack	Cabricán	158	14 \pm 10	2–50	10	10
Fodder	Sack	Cabricán	73	12 \pm 7	3–40	10	10
Game	One	Cabricán	13	46 \pm 9	20–50	50	50
<i>Wage</i>							
Wage	Man-day	Totonicapán	140	41 \pm 16	5–150	40	35
		Cabricán	149	47 \pm 26	15–170	40	30
		Todos Santos	111	47 \pm 18	25–150	40	40
<i>Processed products</i>							
Sawn wood	Dozen	Cabricán	87	103 \pm 45	20–240	80	80
		Todos Santos	7	120 \pm 95	50–300	70	60
Wooden furniture	One	Cabricán	53	139 \pm 150	25–1000	100	100
Utensils	One	Cabricán	26	4 \pm 2	1–7	5	5
<i>Crops</i>							
Maize	100 lbs. Sack	Totonicapán	10	126 \pm 22	75–140	140	140
		Cabricán	143	100 \pm 16	60–140	100	100
		Todos Santos	18	116 \pm 50	90–300	100	100
Wheat	100 lbs. Sack	Cabricán	30	134 \pm 93	60–450	100	100
Potato	100 lbs. Sack	Cabricán	22	139 \pm 36	100–250	142.5	150
		Todos Santos	162	70 \pm 38	25–200	75	25
Cow pea	100 lbs. sack	Cabricán	6	383 \pm 150	150–500	450	500
Dry field beans	100 lbs. sack	Cabricán	26	481 \pm 141	100–700	500	500
		Todos Santos	12	375 \pm 69	250–450	400	400
Squash	One	Cabricán	8	4 \pm 4	1–10	2.5	1
Broad beans	100 lbs. Sack	Cabricán	27	389 \pm 154	100–600	500	500
		Todos Santos	9	250 \pm 33	200–300	250	250
Apple	100 lbs. Sack	Cabricán	17	115 \pm 40	30–150	125	150
Peach	100 lbs. sack	Cabricán	6	72 \pm 65	25–200	55	25
<i>Livestock</i>							
Cows	One	Totonicapán	27	1867 \pm 785	1000–5000	1500	1500
		Cabricán	110	2103 \pm 673	200–5000	2000	2000
Goats	One	Cabricán	19	250 \pm 37	150–300	250	250
		Todos Santos	5	265 \pm 105	125–400	300	300
Sheep	One	Totonicapán	65	161 \pm 56	75–400	150	150
		Cabricán	132	229 \pm 167	50–2000	200	200
Pigs	One	Todos Santos	86	309 \pm 70	200–600	300	300
		Cabricán	216	264 \pm 215	75–2600	200	200
Donkeys	One	Todos Santos	86	342 \pm 207	50–1000	300	300
		Totonicapán	23	1304 \pm 525	700–2500	1000	1000
		Cabricán	56	2414 \pm 694	1000–4000	2500	2500
		Todos Santos	5	2325 \pm 1435	125–4000	2500	
Chickens	One	Totonicapán	25	34 \pm 10	10–50	35	40
		Cabricán	241	49 \pm 13	10–75	50	50
		Todos Santos	82	48 \pm 17	15–100	42.5	40
<i>Other incomes</i>							

Remittances	Transfer	Totonicapán	12	3573 ± 2713	780–9000	2640	2280
		<i>Cabricán</i>	24	6754 ± 5107	400–21000	5500	3000
		Todos Santos	45	2032 ± 2308	200–10000	1000	500
			35	988 ± 578	75–2000	1000	1000
Gifts	Transfer	Todos Santos	35	988 ± 578	75–2000	1000	1000

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Appendix 2. Income sources in *Cabricán*

Product	Observations	Cash income share (%)	Subsistence income share (%)	Total income share (%)	Costs
Unprocessed products					
Timber	11	1.78	6.89	4.51	
Firewood	81	4.78	23.22	14.61	
Mushrooms	21	0.00	0.32	0.17	
Forest litter	74	0.03	0.72	0.40	
Fodder	68	0.26	8.42	4.61	
Processed products					
Sawn wood	78	13.33	4.30	8.52	
Wooden furniture	40	0.93	1.55	1.26	
Utensils	21	0.02	0.04	0.03	
Forest- related income		21.14	45.45	34.10	
Wage	70	41.85	0.00	19.55	
Crops				0.00	
Maize	79	0.41	33.08	17.82	
Wheat	25	0.02	2.83	1.52	
Oat	7	0.00	0.41	0.22	
Potato	21	0.38	1.93	1.20	
Cow pea	8	0.02	1.06	0.57	
Dry field beans	23	0.12	1.45	0.83	
Squash	6	0.01	0.77	0.41	
Broad beans	24	0.45	0.78	0.62	
Cauliflower	1	0.00	0.00	0.00	
Plum	1	0.02	0.00	0.01	
Peach	6	0.02	0.15	0.09	
Livestock	72	5.57	10.88	8.40	
Animal products	79	1.76	1.19	1.46	
Business	10	1.56	0.00	0.73	
Remittances	11	25.78	0.00	12.04	
Other incomes	7	0.90	0.00	0.42	
Unprocessed products collection	63	0.00	0.00	0.00	-36905
Processed products	30	0.00	0.00	0.00	-15522
Agricultural inputs	78	0.00	0.00	0.00	-140346
Livestock inputs	59	0.00	0.00	0.00	-37818
Total		100.00 (628749.01)	100.00 (717245.76)	100.00 (1345994.77)	-230591
Net income					1115603.77

Appendix 3. Income sources in *Todos Santos Cuchumatán*

Product	Observations	Cash income share (%)	Subsistence income share (%)	Total income share (%)	Net income
Unprocessed products					
Timber	10.00		21.80	5.44	
Firewood	64.00	0.10	19.93	5.05	
Mushrooms	7.00	0.00	0.05	0.01	
Forest litter	16.00	0.00	1.86	0.46	
Fodder	21.00	0.03	2.12	0.55	
Processed products					
Sawn wood	15.00	0.07	4.47	1.17	
Wooden furniture	1.00	0.00	0.07	0.02	
Utensils	2.00	0.00	0.01	0.00	
Forest-related income		0.19	50.31	12.71	
Wage	59.00	11.74		8.81	
Crops		0.00	0.00	0.00	
Maize	22.00	0.00	6.63	1.66	
Oat	2.00	0.00	0.89	0.22	
Potato	61	75.42	34.01	65.08	
Broad beans	7.00	1.49	1.03	1.38	
Broccoli	1.00	2.53	0.00	1.89	
Onion	1.00	0.21	0.03	0.17	
Chilli	1.00	0.00	0.00	0.00	
Cauliflower	1.00	0.03	0.03	0.03	
Livestock	54.00	0.83	4.82	1.83	
Animal products	38.00	0.17	2.24	0.69	
Business	1.00	0.03	0.00	0.02	
Remittances	19.00	5.13	0.00	3.85	
Other incomes	30.00	2.22	0.00	1.67	
Unprocessed products collection	41.00	0.00	0.00	0.00	-34325
Agricultural inputs	65.00	0.00	0.00	0.00	-542060
Livestock inputs	25.00	0.00	0.00	0.00	-27240
Total		100.00	100.00	100.00	-603625
		(1781917.17)	(592987.92)	(2374905.09)	
Net income					1771480.09

Appendix 4. Income sources in Totonicapán

Product	Observations	Cash income share (%)	Subsistence income share (%)	Total income share (%)	Costs
Unprocessed products					
Firewood	37.00	0.04	36.18	7.83	
Mushrooms	14.00	0.11	5.12	1.19	
Forest litter	22.00	0.00	27.08	5.83	
Game	10.00	0.00	1.91	0.41	
Processed products					
Utensils	6.00	0.00	0.09	0.02	
Forest-related income		0.15	70.38	15.28	
Wage	41.00	81.54	0.00	63.98	
Crops				0.00	
Maize	19.00	0.50	24.39	5.64	
Potato	1.00	0.29	0.11	0.25	
Livestock	11.00	0.15	0.57	0.24	
Animal products	23.00	0.04	4.56	1.02	
Business	2.00	0.51	0.00	0.40	
Remittances	9.00	16.81	0.00	13.19	
Agricultural inputs	36.00	0.00	0.00	0.00	-41017
Livestock inputs	10.00	0.00	0.00	0.00	-4068
Total		100.00 (255051.31)	100.00 (70027.53)	100.00 (325078.84)	-45085
Net income					280193.84