



Social Impact Assessment for REDD+ in Keo Seima Wildlife Sanctuary



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ABBREVIATIONS AND ACRONYMNS

BNS	Basic necessity survey
CCBA	Climate, Community and Biodiversity Alliance
FA	Forestry Administration
KSWS	Keo Seima Wildlife Sanctuary
ICT	Indigenous communal title
MoE	Ministry of Environment
MFI	Microfinance institution
NTFP	Non-timber forest product
PA	Protected area
REDD+	Reduced emissions from deforestation and forest degradation
SBCA	Seima Biodiversity Conservation Area
SPF	Seima Protection Forest
WCS	Wildlife Conservation Society

EXECUTIVE SUMMARY

This aim of this report is to evaluate the trends in key social indicators identified to monitor the social impact of the REDD+ in Keo Seima Wildlife Sanctuary (KSWS), which is managed by the Royal Government of Cambodia's Ministry of Environment with technical assistance from the Wildlife Conservation Society. Following the social monitoring framework designed for KSWS in 2012, a household survey was conducted in each of the 20 villages participating in the REDD+ project, with a minimum of 30 households surveyed in each village. Trends were assessed for each indicator for the period from 2012 to 2017.

With respect to household economic wellbeing, the results of the 2017 survey were encouraging (Table i). On average households are becoming better off. Indigenous households, which were slightly poorer on average in 2012, have reversed this disadvantage. Other vulnerable groups, such as landless, female headed and labour selling households, are still disadvantaged but are becoming better off at the same rate as other households. Households living in more remote villages, which were previously found to be poorer on average, are now becoming better off at a greater rate than households in more developed villages. However, households that own resin trees, previously an important and sustainable forest-based livelihood, were found to be no longer better off than households that do not own resin trees.

The indicators for the security of natural resources paint a mixed picture. On the one hand, the collection of non-timber forest products and wild protein sources remains strong, while resin tree owners were found to have more trees on average than in 2012. A significant majority of people also felt secure about their access to land, with many citing indigenous land titling as the reason they felt secure. Conversely, there has been a significant reduction in the proportion of households owning resin trees, although this is partly explained by the increase in the number of households living in the area. Similarly, only 30.9% of resin tree owners feel secure about their trees. However, in general, the indicators show that the project is still having a net benefit relative to a no-project scenario. The main indicators used to assess land sufficiency also showed positive trends between 2012 and 2017, with the average land held by households increasing from 2.1 ha to 2.6 ha and the percentage of land sufficient households increasing from 70.2% to 80.3% of households across the landscape.

The trends in the threats to social outcomes identified in the conceptual model also present a mixed picture. The proportion of households to have attended village meetings and access to off farm livelihood opportunities, two areas which the project actively seeks to address through community outreach, institutional development and protection of forest resources, showed positive trends. Conversely, cassava productivity has fallen and household debt has increased significantly. Population, one of the major drivers of social and environmental change across the landscape could not be assessed due to concerns about the reliability of data. However, it is thought to have increased

significantly in the past five years. These more negative trends suggest that there is a risk that some of the positive trends in households economic wellbeing and access to land could be slowed on even reversed if not addressed.

Table i: Summary of key social indicator trends for the period from 2012 to 2017. Projected trends under the no project scenario are described in greater depth in Appendix C.

Category	Indicator	No Project Trend	2017 Trend
Economic wellbeing	Average household BNS score.	↓↑	↑
Natural resources	Resin tree ownership	↓	↓
	No. of resin trees owned	↓	↑
	No. of resin trees lost	↑	↑
	NTFP collectors	↓	↑
	Reported income from NTFP collection	↓	↓
	Wild meat meals consumed	↓	↑
Land use	Average land holdings	↓↑	↑
	Rice sufficiency	→	↑
	Land sufficiency	→	↑
Threats	Population growth	↑	DD
	Land alienation	→	→
	Lack of voice	↑	↓
	Limited agricultural productivity	↑→	↑
	Scarcity of off-farm livelihoods	→	↓
	Household debt	↑	↑

Overall, while project performance as measured against some indicators has not met projections for the with-project scenario, all indicators show an improved (9 indicators) or similar performance (four indicators) to that expected under the no project scenario. As such, the survey findings suggest that the project continues to have a net positive impact on households (including those belonging to vulnerable groups) living inside each of the 20 villages participating in the REDD+ project.

INTRODUCTION

The assessment of social impacts is an important element of conservation area management. This is particularly true for reduced emissions from deforestation and forest degradation (REDD+) projects that seek to provide benefits for local people. Without such assessments, it is impossible to understand whether communities are truly benefiting from project activities, or whether they are incurring any unintended negative impacts. This report covers the assessment of social impacts from the REDD+ in Keo Seima Wildlife Sanctuary project over the period 2012 to 2017 and follows the methodology described in the social monitoring framework developed by Travers and Evans (2013).

The Keo Seima Wildlife Sanctuary REDD+ Project

Keo Seima Wildlife Sanctuary (KSWs) is a protected area (PA) located in the Eastern Plains Landscape of Cambodia and covers an area of 2,927 km² (Fig. 1). Originally part of the Samling International Ltd. logging concession, the site was gazetted for the purposes of biodiversity conservation in 2002 and is now managed by the Ministry of Environment (MoE) of the Royal Government of Cambodia with technical and financial support from the Wildlife Conservation Society (WCS) Cambodia Programme.

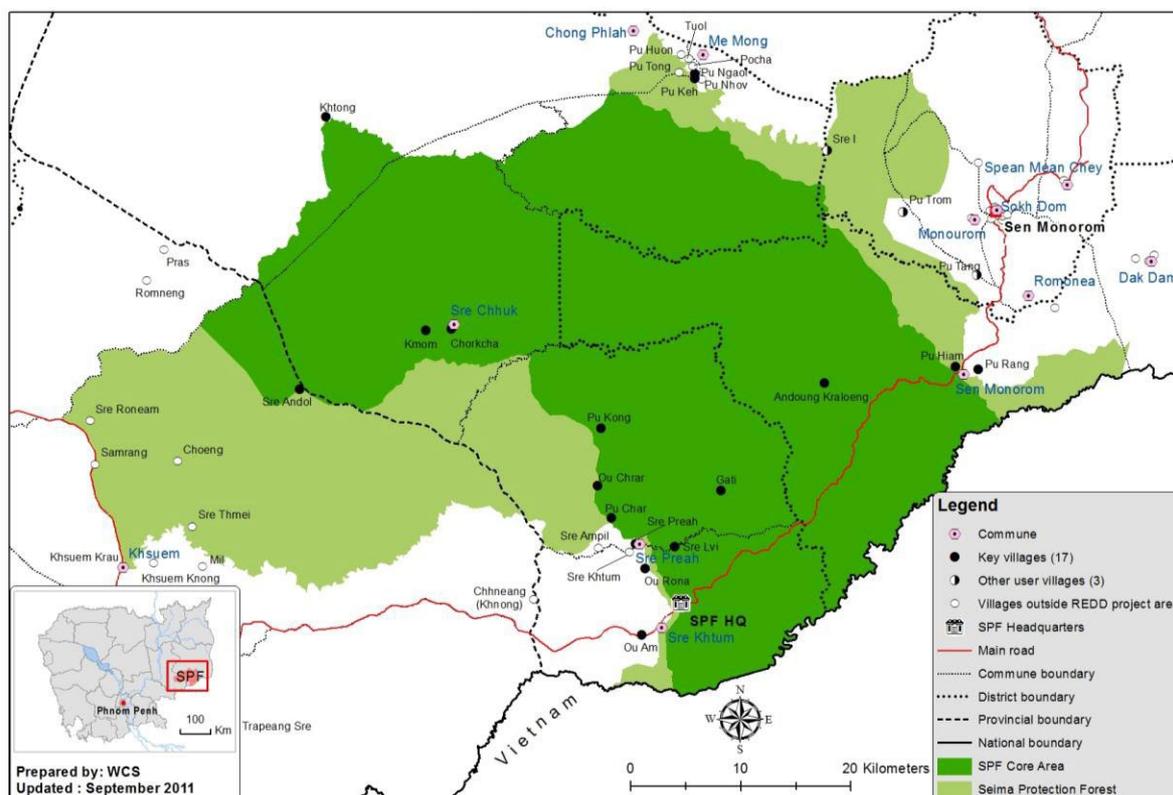


Figure 1: Map of Keo Seima Wildlife Sanctuary REDD+ Project Area showing participating villages.

In 2009, a project was initiated at KSWs with the aim of enhancing local livelihoods and reducing emissions from deforestation. This project is one of two national demonstration REDD+ projects and is being led by WCS at the request of the Cambodian

government. The project area is defined by KSWS's Core Protection Zone (1,885 km²), with the remaining area within the protected areas classified as a buffer zone (1,042 km²). Seventeen villages are located within the REDD+ project area, with another three villages defined as key-user villages as they contain households who make use of resources within the project area.

Livelihoods

The project area is predominantly populated by the indigenous Bunong people and is commonly separated into three broad livelihood zones: an upland zone, a paddy zone and a cash crop zone (Travers et al. 2016). Villages in the upland zone are largely located in the hilly eastern section of KSWS, which rises towards the Sen Monorom Plateau. Households living in this zone were traditionally dependent on the production of upland rice and vegetables in *chamkar* fields (shifting cultivation) and supplemented their income with the sale of liquid resin collected from dipterocarp trees. Increasingly, however, livelihoods have shifted towards the production of cash crops, such as cassava and cashew, particularly in villages with good road access (Travers et al. 2015).

The paddy zone is located in the central and north-western section of KSWS, mostly in areas dominated by dry dipterocarp forest. In these villages, both paddy and chamkar rice is cultivated and the collection of liquid resin was also traditionally a significant source of income. The process of agricultural commercialisation has proceeded at a slower rate in the paddy zone, largely due to the inaccessibility of villages in Sre Chuuk commune and poor soils for growing cassava.

The cash crop zone is located in the accessible southern section of the project area. Here the commercialisation of agriculture is more advanced, with a high proportion of households dependent on cash income from agriculture to buy sufficient rice to feed themselves. This section of the protected area has benefited from being located close to the Vietnamese border and Highway 76 to Sen Monorom, and is well served by markets, traders and migrant labour.

Management

From 2002 to 2016 KSWS was managed by the Forestry Administration (FA), first as Seima Biodiversity Conservation Area (SBCA) and later, following Prime Ministerial Subdecree #143, as Seima Protection Forest (SPF). In 2016, management of all Cambodia's PAs was transferred to the Ministry of Environment (MoE) and SPF was renamed Keo Seima Wildlife Sanctuary.

To date, conservation activities at the site have focussed on law enforcement and land use planning. The process of indigenous communal titling (ICT) has been undertaken in 13 of the REDD+ village. Seven of these villages have received title, while another six are waiting for their provisional title to be approved. The ICT process transfers community land from state public land to state private land and grants indigenous communities rights over this land. Zones are designated within each titled area for agricultural and

residential use, with areas set aside for future expansion, and local rules drawn up for the community to manage land use within their ICT. This is a hugely important foundation for the REDD+ project as it defines the areas in which communities can legally clear land for agriculture and empowers them to manage resources.

In addition to the ICT process, an important component of the REDD+ project is the sharing of benefits from the sale of carbon credits (Milne et al. 2012). The system through which benefits will be distributed is currently under development, with the first round of disbursements due in late 2017/early 2018.

SOCIAL MONITORING IN KEO SEIMA WILDLIFE SANCTUARY

Monitoring Framework for Social Impact Assessment

As part of the requirements for the REDD+ project's certification by the Climate, Community and Biodiversity Alliance (CCBA), a monitoring framework was developed to track trends in a number of key social indicators (Travers and Evans 2013). This framework was based on the conceptual model for conservation activities at the site (Fig. 2) and comprises multiple elements, including a landscape wide household livelihood survey to be conducted every five years. It was originally intended that regular surveys conducted as part of on-going management of the site, such as the biannual demography survey of villages across the wider landscape, would form part of the social monitoring framework (Travers and Evans 2013). However, these surveys have since been discontinued and will not be reported on here.

Although the first landscape household livelihood survey was conducted as part of the REDD+ project in 2012, an earlier survey had been conducted in many of the same villages in 2006/7. These two surveys formed the basis of the original social impact assessment, which was conducted in 2012 and was intended to serve as a baseline against which to compare future changes in the selected social indicators. In 2016, a qualitative study of changes in livelihood priorities was conducted in order to assess the continued validity and relevance of the project's conceptual model and social indicators (Walker 2016). Following this study, the list of indicators to be assessed in the 2017 was updated.

Indicators

Following the conceptual model for conservation activities (Fig. 2), indicators for monitoring the social impact of the project are grouped into four categories: household economic wellbeing, security and productivity of natural resources, land use and productivity and threats to project outcomes (Table 1).

Indicators were assessed for all households, as well as vulnerable groups identified by the monitoring framework. These include widows, non-timber forest product (NTFP) collectors, indigenous households, labour sellers and resin tappers.

Quantitative Household Survey

The household survey was conducted between May and June 2017 in all 20 REDD+ villages. In each village, at least 30 households were randomly selected for inclusion in the survey, with 620 households interviewed overall. Sampling was stratified by settlement such that villages that are separated into discrete settlements were sampled proportionally by settlement. All interviews were conducted with the head of the household or, where the household head was unavailable, their spouse.

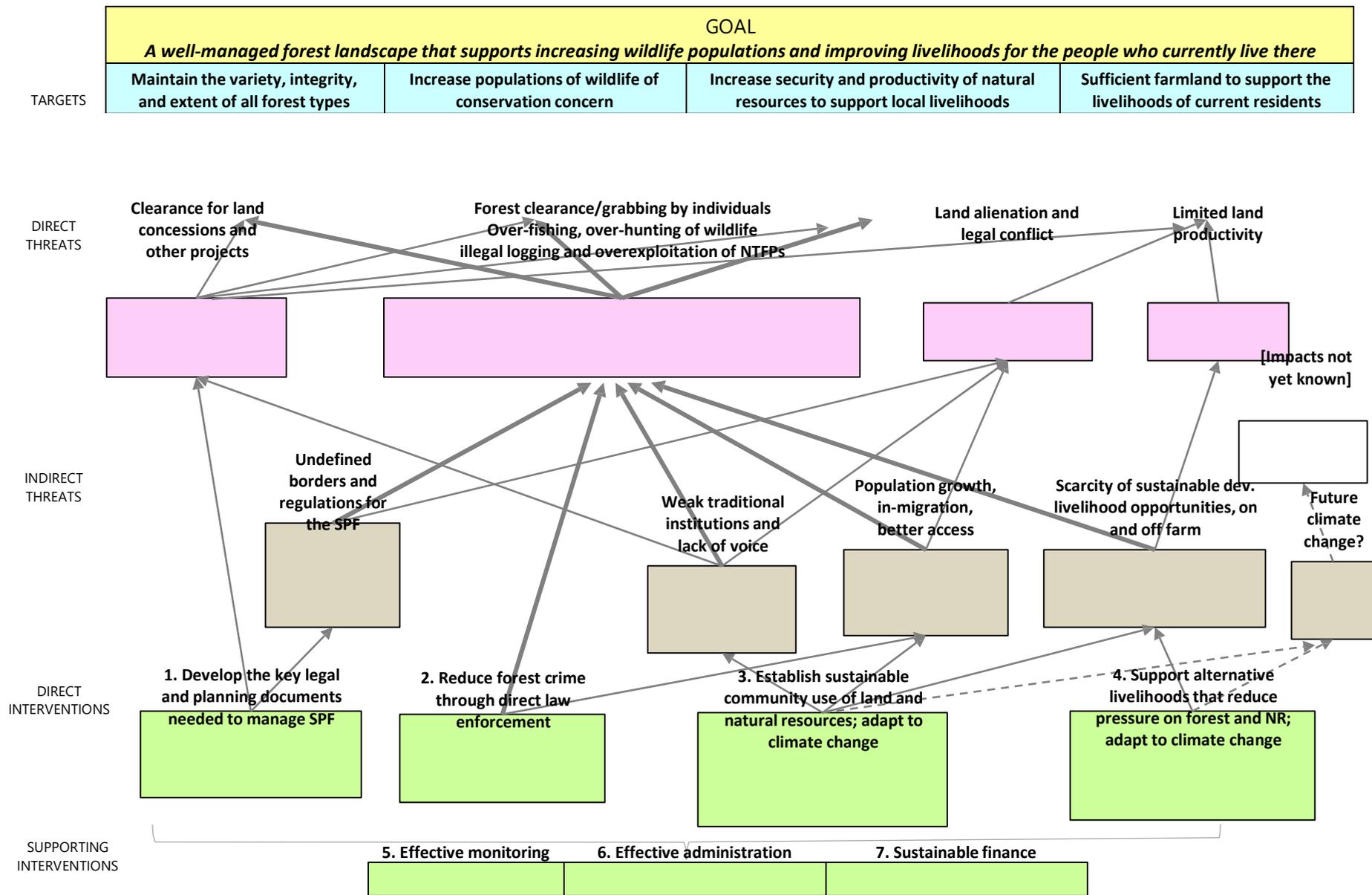


Figure 2: The conceptual model developed for the SPF (now KSWS) core area, which was used as the basis for the social impact monitoring framework developed for the REDD+ project (Travers and Evans 2013).

Table 1: Table of indicators plus expected trends for the no project scenario and trends found in 2012. Some trends were not assessed in 2012 due to a lack of baseline data from 2006/7. Projected trends under the no project scenario are described in greater depth in Appendix C.

Category	Indicator	No Project Trend	2012 Trend
Economic wellbeing	Average household BNS score.	↓↑	↑
Natural resources	Resin tree ownership	↓	↓
	No. of resin trees owned	↓	↑
	No. of resin trees lost	↑	not assessed
	NTFP collectors	↓	→
	Reported income from NTFP collection	↓	not assessed
	Wild meat meals consumed	↓	→
Land use	Average land holdings	↓↑	↑
	Rice sufficiency	→	not assessed
	Land sufficiency	→	not assessed
Threats	Population growth	↑	↑
	Land alienation	→	↓
	Lack of voice	↑	not assessed
	Limited agricultural productivity	↑→	not assessed
	Scarcity of off-farm livelihoods	→	not assessed
		↑	

Analysis

In order to account for the variation in population size between villages, projected means were calculated for the landscape, weighting by population size in each village. These projections are only at village level and so do not take account of household characteristics, such as ethnicity.

All statistical models were analysed in the lme4 package (version 1.1-13; Bates et al. 2015) in R (version 3.3.3; Core Development Team 2017) using RStudio (version 1.0.136; RStudio Team 2016). For each analysis, a number of household demographic and livelihood variables were investigated as explanatory variables. Backwards stepwise model selection was done on the basis of AIC values. If comparison of candidate models produced a Δ AIC value of less than two then the most parsimonious model was selected, otherwise the model with the lowest AIC was selected. Interactions between key household variables and time period were tested to check whether vulnerable groups were experiencing the same trends as non-vulnerable households. Continuous variables were standardised by subtracting the mean and dividing by twice the standard deviation following Gelman (2008).

HOUSEHOLD ECONOMIC WELLBEING

Indicator Description	Indicator Status/Trend	Additional Comments
Average household BNS score.	Projected household average BNS score increased from 14.0 in 2012 to 16.7 in 2017 across the landscape.	High variation in BNS score between villages but remote villages becoming better off faster than towns. Widows, labour sellers and landless remain vulnerable but are becoming better off at same rate as the wider population.

For the purposes of the social impact assessment, household economic wellbeing is measured using the basic necessity survey (BNS; Davies 1997). This is a participatory poverty score, which is derived from household ownership of key assets and access to basic services such as medical care and education. The list of items included in the survey (see Appendix A), was generated during a workshop with 24 participants from the three livelihood zones, which was held in April 2012. Two additional items were added to the list for 2017.

Each respondent was asked whether they owned or had access to each of the items in turn, as well as being asked whether they believed the item conformed to the definition of a basic necessity, which was given as “*items that everyone in the community should be able to have and nobody should have to go without*”. Household scores were calculated by summing the number of items an individual household owned or had access to, with a weighting applied of the proportion of survey participants who responded that each item was a basic necessity. Hence, households with a lower BNS score are poorer than households with a higher score. Items for which fewer than 50% of the sample felt met the definition for basic necessities were discounted. To make comparisons between time periods, 2012 weightings were used.

Trend in Household Economic Wellbeing

In 2012, household BNS scores ranged from 2.9 to 24.1 (out of a maximum possible score of 29.5), with a mean of 13.0 (Fig. 3). In 2017, while the range of household BNS scores remained very similar to 2012, ranging from 4.0 to 25.2, the mean score of 16.7 was much higher in comparison with 2012. This suggests that while there is still significant economic inequality across the landscape with some households only having access to the most basic of household items and services, average household economic wellbeing has improved significantly over the past five years. This is reflected in the projected mean scores across the landscape, which were 14.0 in 2012 and 16.5 in 2017.

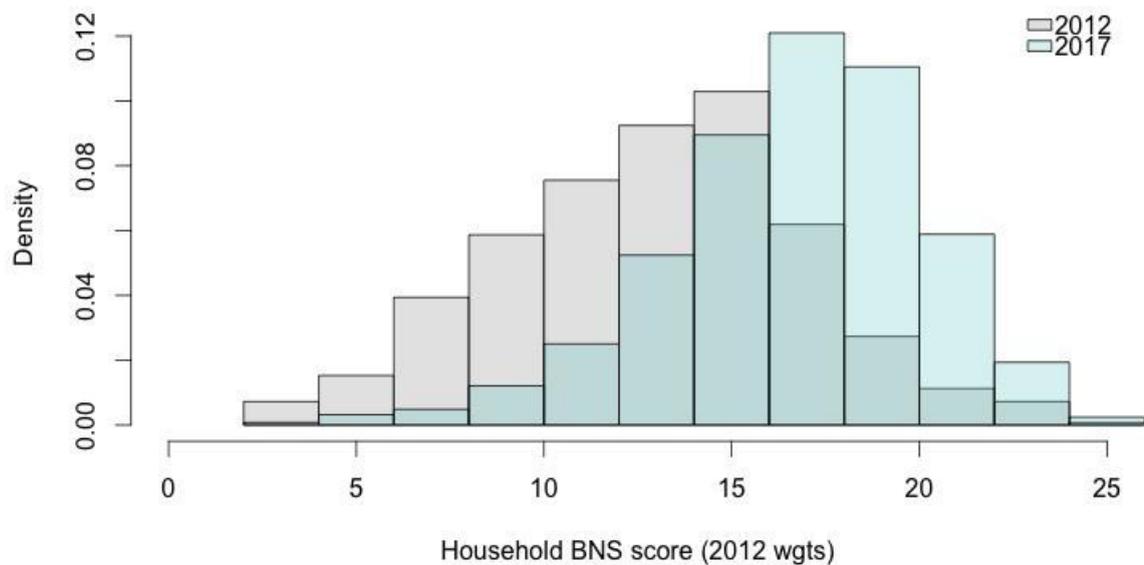


Figure 3: Household BNS score for 2017 (N = 622).

A linear mixed regression model was used to quantify the increase in household BNS score between 2012 and 2017 and assess whether individual household characteristics and livelihood strategies were significantly associated with this trend (Table B.1, Appendix B). The results of this model show that reported household land holdings and households that operated a shop, had at least one source of off-farm income or in which the head of the household had received at least one year of education were all associated with higher BNS scores in both 2012 and 2017. Conversely, female headed and labour selling households were associated with lower scores in both time periods. This implies that although landless, labour selling and female headed households remain vulnerable, their economic wellbeing is increasing at the same rate as the wider population.

The effect of two variables changed over the five years (Table B.1, Appendix B). While indigenous households (households belonging to the Bunong and Stieng minority ethnic groups) were found to be poorer in 2012 than non-indigenous households, this effect had been reversed by 2017. The model also shows the diminishing importance of resin collection to people’s livelihoods, such that the positive association between resin ownership and household BNS score in 2012 was reversed in 2017.

With respect to spatial variation across the landscape, the previous impact assessment conducted in 2012 found significant variation between mean household economic wellbeing in different villages and that this had increased in the five years prior to the assessment. While households in more remote villages, such as those in Sre Chhuk commune, remain poorer on average than those in better connected villages, the trend in increasing variation has been reversed, with households in poorer villages found to be becoming better off at a greater rate (Fig. 4). One possible explanation for this is that improved road access has enabled households in these villages to take advantage of new markets which had become open to other villages during the previous time period.

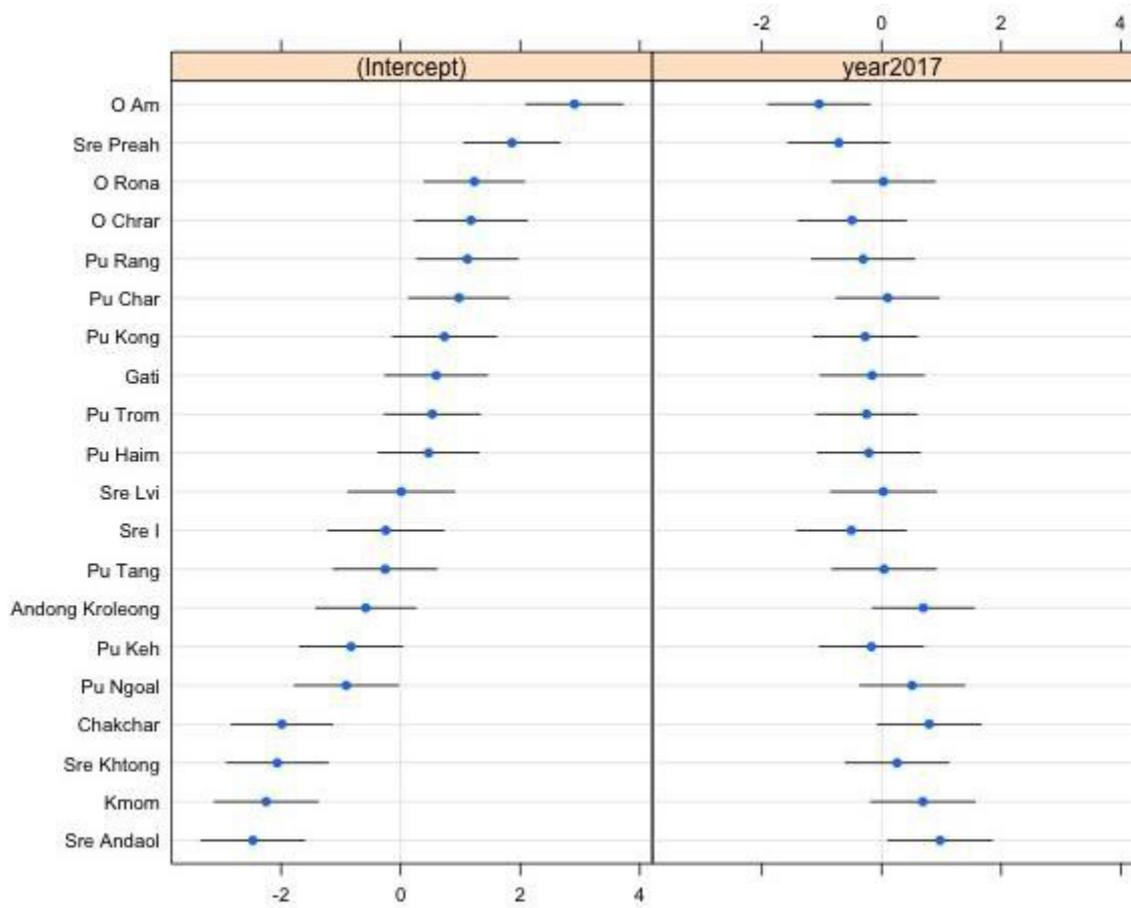


Figure 4: Mean household BNS score for each of the 20 REDD+ villages. The left panel shows the spatial variation in BNS score in 2012. The right panel shows the change in BNS score between 2012 and 2017 by village.

SECURITY AND PRODUCTIVITY OF NATURAL RESOURCES

Target 1 of the conceptual model (Fig. 2) is to increase the security and productivity of natural resources to support local livelihoods. Under this target, the social monitoring framework identifies six performance indicators (Table 1).

Resin Trees

Indicator Description	Indicator Status/Trend	Additional Comments
Resin tree ownership is split into two separate indicators: whether a household owns any trees and, if they do, how many they own.	The projected percentage of households owning trees has declined from 33.9% to 20.2%.	Indigenous households, those with a greater number of members and NTFP collectors are more likely to own resin trees.
A secondary indicator of household resin tree security is the number of households reporting resin tree losses to ELCs or loggers.	The number of resin trees owned by resin tappers has increased from 93 to 137 trees per household since 2012. 89 households reportedly lost trees at an average of 138 trees each.	Resin tapping households with higher BNS scores own more trees.

Resin tree ownership

The collection of liquid resin has traditionally been a vital source of income for people living inside KSWs (Evans et al. 2003). However, the importance of this resource has slowly been changing. Successive research studies have shown that fewer households who own resin trees now actively collect resin (Cheetham 2014) and that people no longer rate resin tree ownership as being important for their livelihoods (Walker 2016). The reasons for this are complex but stem in part from greater integration with external markets, which has provided additional streams of income, particularly from cash crops (Travers et al. 2015). However, the threat of losing trees to illegal logging may also have contributed to this trend. Resin trees are often located far from the owner's house, making them difficult to protect. Although illegal, tree owners may choose to sell their trees or cut the trees themselves and sell the timber in order to receive some compensation before losing their trees to illegal loggers. This may explain the significant drop in resin tree ownership between 2006/7 and 2012, which fell from 44.7% to 33.9% of households across the landscape. In 2017, the projected ownership for 2017 was 20.2% of households, which suggests that the rate of decline in ownership has continued for the period from 2012 to 2017. It is likely that some of this decline is due to the increasing number of households present across the landscape. Unfortunately, it has not been possible to assess this effect, as comparison of the population data collected in 2012 and 2017 is considered unreliable.

The results of a generalised linear mixed model of resin tree ownership suggest that resin tree ownership suffered a significant decline among households that do not collect

other non-timber forest products (Fig. 5; Table B.2, Appendix B). For households that collect NTFPs the decline was significantly less severe. In general, indigenous and larger households were found to be more likely to own resin trees, while households with at least one member in permanent employment, that sell their labour or are landless were found to be less likely to own resin trees.

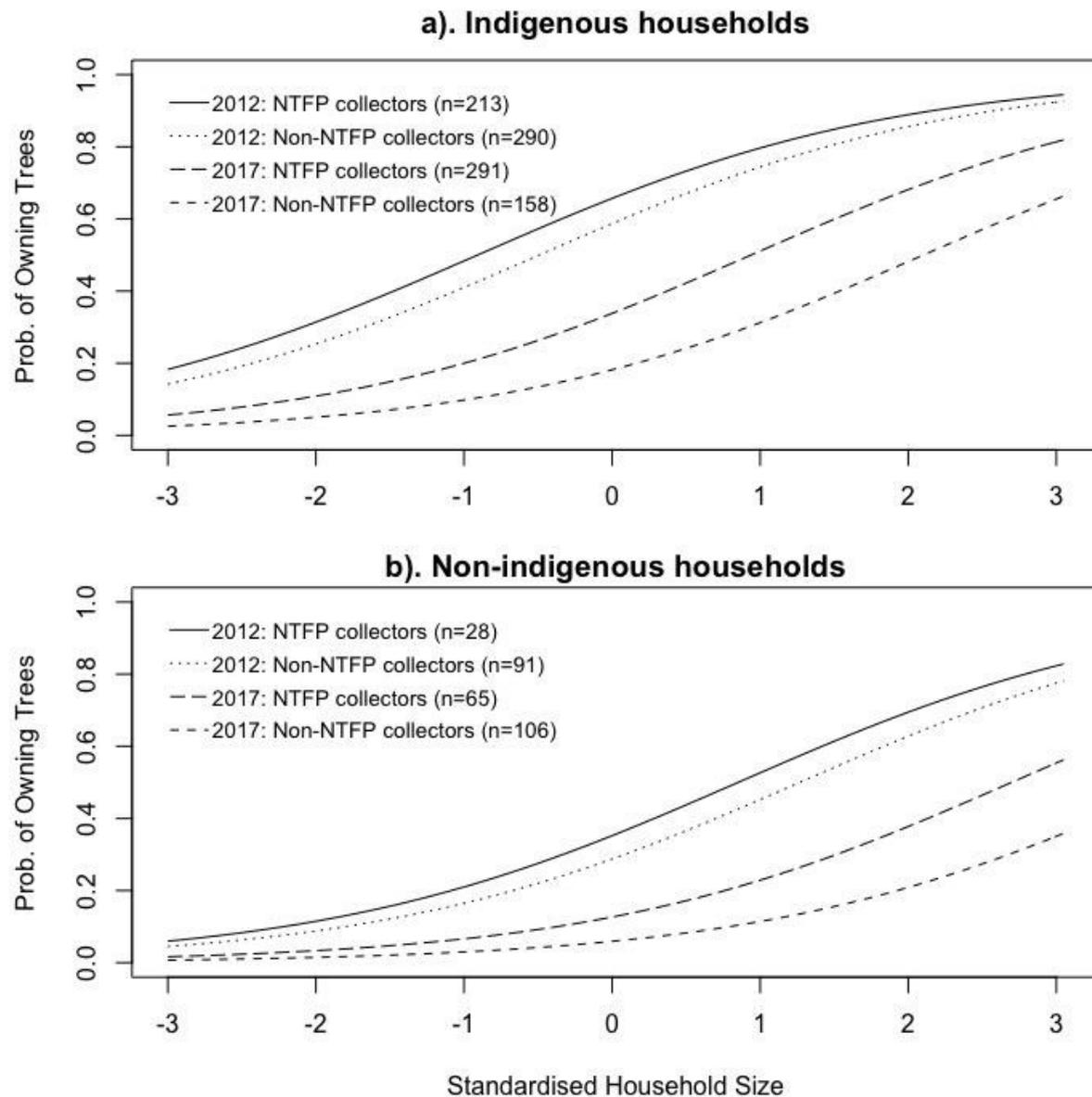


Figure 5: Resin ownership among a). indigenous households and b). non-indigenous households.

Number of resin trees owned

By modelling the number of resin trees owned by resin tree owning households, household resin tree ownership was found to have increased significantly since 2012 (Table B.3, Appendix B). On average, resin tree owning households owned 93 trees in 2012 but were estimated to have 44 more trees each in 2017. The number of resin trees owned was also found to increase with household economic wellbeing, which suggests

that better off households may be acquiring trees from poorer households. As in 2012, landless resin tree owning households were found to have significantly more trees than average, suggesting that some households may have chosen to specialise in resin collection.

Resin trees lost

The proportion of households who lost resin trees to economic land concessionaires or illegal logging has increased significantly (Table B.4; Appendix B). In 2012, 23 households (3.7%) reported losing trees but this increased to 89 households (14.3%) in 2017. The households most likely to have lost trees were the same as those found to be more likely to own trees (indigenous households, larger households and households that collect NTFPs). The average number of trees reported lost (by households who reported losing trees) also increased from 115 trees in 2012 to 138 trees in 2017. This translates to a loss of nearly 12000 trees between 2012 and 2017 among sampled households and would account for nearly 50% of the trees owned in 2017.

Non-Timber Forest Product Collection

Indicator Description	Indicator Status/Trend	Additional Comments
The main indicator of NTFP collection is the number of households involved with this activity. A secondary indicator in future years will be average harvest offtakes.	Across the whole project area, 49.0% of households are projected to collect NTFPs. The number of households involved in NTFP collection was constant between survey years.	NTFP collection is positively correlated with indigenous, labour selling and resin tapping households.

The collection and use of non-timber forest products has traditionally been an important component of Bunong livelihoods. As with liquid resin, some NTFPs are collected for sale as a source of income, while others, such as forest vegetables, are mostly consumed in the home. These latter resources are particularly important for poorer, more vulnerable households. Hence, the collection and sale of NTFPs are important indicators of the security and productivity of natural resources that contribute to the livelihoods of local people.

In 2017, the projected percentage of people living across the landscape collecting and selling NTFPs was 49.0% and 21.4% respectively. While the proportion of people selling NTFPs has remained constant since 2012, the percentage of NTFP collectors has risen significantly from 30.3%. This suggests that the importance of NTFPs to local livelihoods not only remains strong but is increasing. This result is reflected in the parameter estimates of a generalised linear mixed model (Table B.5, Appendix B), which finds a 16.4% increase in the probability of a household collecting NTFPs between 2012 and 2017 once other explanatory factors had been controlled for. The model also found larger and indigenous households, resin tappers and households selling labour or cash crops had a significantly higher probability of collecting NTFPs, while households that

owned a shop or had at least one member in employment were less likely to collect NTFPs.

With respect to the different resources harvested (Table 2), the two most valuable crops in terms of total income across the sample and average earnings per household were solid resin and wild honey, with the majority of collectors doing so exclusively for sale. Conversely, rattan, wild vegetables and bamboo were collected by many households but predominantly for consumption in the home. From the two most valuable crops in terms of income, wild honey has kept its value to local people but the number of households collecting solid resin has reduced by 45%, while the total income from the sale of solid resin has shrunk by 55%.

Table 2: Reported NTFP harvests for the 621 households sampled in the 2017 household survey. Reported net incomes are financial only and do not value home consumption.

NTFP	Collectors	Average distance to harvest [km]	Sellers	Income [\$/HH]	Total income [\$]
solid resin	55	9.5	52	116	5924
rattan	165	5.2	16	60	815
bamboo	100	1.6	5	41	207
mushrooms	136	7.0	42	70	2885
vine/liana	46	2.0	10	45	450
wild vegetable	208	1.7	1	-	-
wild fruit	6	2.8	2	31	32
wild honey	29	16.0	27	195	5060

The average distance travelled to harvest each of the key NTFPs was not recorded in 2012 but has been added to the monitoring framework for future assessments.

Wild Protein Meals

Indicator Description	Indicator Status/Trend	Additional Comments
The number of meals eaten per household in one week that included wild animal protein (i.e. fish or meat).	The average number of wild protein meals increased from 2.9 to 5.5 per household per week. Increase due to increase in wild fish meals. Wild meat meals fell from 1.1 to 0.7.	High variation in the number of meat meals eaten per week between villages. Statistical analysis suggests the number of wild meat meals eaten is driven less by opportunity than in 2012 and more by preference.

The number of wild protein meals is an important indicator of the extent to which harvested natural resources continue to be valued by local people. Trends in the number of wild meat meals consumed should be interpreted in the context of associated

trends in meat meals from domestic sources or purchased from local markets. In 2012, the mean number of meals containing protein from wild sources was 2.9, while the number containing domestic or purchased protein was 9.0. In 2017, the mean number of meals containing animal protein from wild sources had increased to 5.5, while the number of meals with domestic meat or purchased fish remained constant at 8.9. This means that the average number of meals containing animal protein increased overall and suggests that the increase in meals containing animal protein from wild meals was not due to people switching from alternative sources. This increase was driven by an increase in the number of meals containing own caught fish, whereas the number of meals containing meat from terrestrial wildlife fell from 1.1 meals per week to 0.7. Hence, although local people’s consumption of animal protein from wild sources has increased overall since 2012, consumption of terrestrial wildlife fell. At this stage, it is not clear whether this decline can be attributed to reduced availability (i.e. declining populations of terrestrial wildlife) or changing preferences.

Modelling the number of meals consumed per week also shows underlying changes in the characteristics of households that are consuming protein from wild sources (Table B.6, Appendix B). In 2012, the number of wild protein meals consumed was closely linked to a household’s opportunity to hunt or fish. Poorer households were also more likely to consume more meals containing wild meat. Conversely, in 2017, better off households were found to consume 1.2 more meals a week with wild meat. Similarly, consumption linked to availability has largely been reversed, with larger households and NTFP collectors found to consume 0.4 and 1.0 fewer wild meat meals respectively in 2017 than in 2012. These changes suggest that consumption of wild meat may be becoming driven less by opportunity and more by preference. This is supported by variation in consumption between villages (Fig. 6).

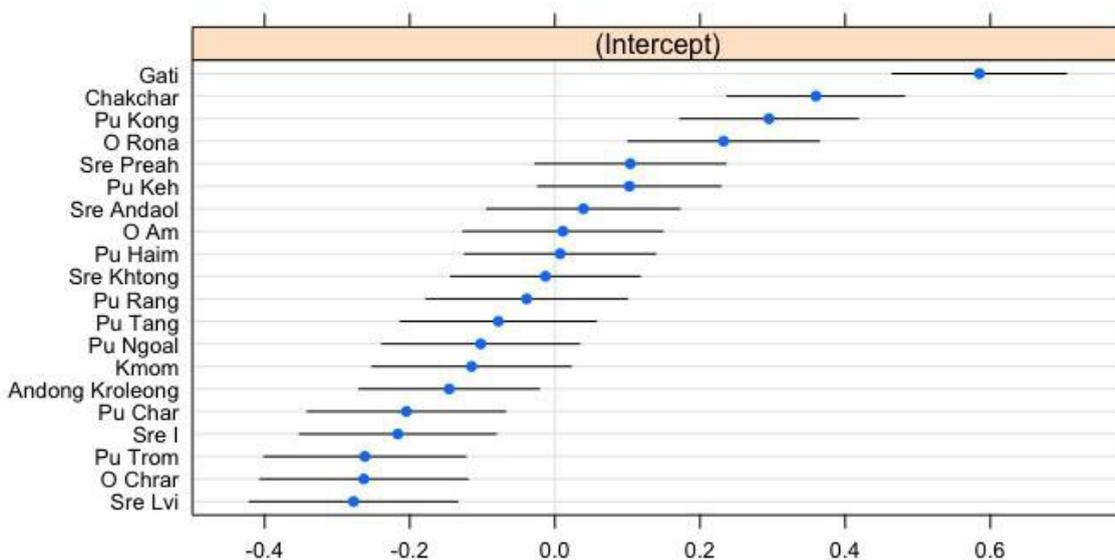


Figure 6: Wild meat meals consumed in different REDD+ villages in 2012 and 2017.

While the three villages in which consumption of wild meat is greatest are all more remote villages, consumption of wild meat has increased relatively for villages with greater access to markets, such as O Rona, Sre Preah and O Am.

Household Resource Security

Indicator Description	Indicator Status/Trend	Additional Comments
Percentage of interview respondent households that report that they feel that their land, resin trees and other resources are secure.	The projected percentage of households across the whole project area that feel secure about their resources is 70.0% for land and 30.9% for resin tree owners.	Conservation activities were cited as the main reason why people felt secure. ELCs and logging identified as the main threats.

The final indicator used to assess the security of the natural resources on which people's livelihoods depend is simple perceptions of security. In 2012, this indicator was applied generally to all natural resources, with 47.6% of households reportedly secure in their access to natural resources. In 2017, the indicator was split into land and resin trees as the trends in these two resources were thought to be diverging. This was borne out by the results, which found the projected average across the landscape of 70.0% of households who felt secure about their access to land. In the majority of cases (54.8%), people attributed this sense of security to the fact that they had received legal title (either individual or communal) or their land had been recognised by the commune or village chief. This is a significant increase from 2012, when very few households had received land title. Conversely, only 30.9% of resin tree owners felt that their resin trees were strongly or fairly secure. This is a concern, as there is a strong incentive for households that doubt the security of their resin trees to sell them or cut them down for timber. For both land and resin trees, the main reason given why people felt insecure about their natural resources was the presence of ELCs, illegal loggers also commonly cited by resin tree owners. A small proportion of households (15.2% of households who felt insecure) reporting feeling insecure about their land because they only had communal title, rather than individual title.

LAND USE AND PRODUCTIVITY

Target 2 of the conceptual model (Fig. 2) is to ensure sufficient farmland is available to support the livelihoods of current residents of KSWs. Under this target, the social monitoring framework identifies two performance indicators (Table 1): the area of land farmed and average household land/rice sufficiency.

Household Land Use

Indicator Description	Indicator Status/Trend	Additional Comments
Average household land holdings of land owning households.	The projected average household land holdings for villages sampled in both surveys increased from 2.1 ha in 2012 to 2.6 ha in 2017.	The area of land claimed by households with land is positively correlated with household BNS score, household size the age of the household head, whether a household is involved in commercial agriculture, whether a household is in debt and the number of cattle owned.

The area of land owned per household is an important indicator of household land use and productivity, particularly as access to markets increases and agriculture becomes a source of income as well as food. Access to land has also been a key focus of conservation activities, with significant effort put into assisting local communities through the process of claiming title over their communal lands. As such, it is expected that the area of land available to people will have increased over time. In 2012, the average area of productive land held by households that owned land was 2.1 ha, up from 1.8 ha in 2006/7. By 2017, this had increased to 2.6 ha per household, which suggests that the rate of increase of land held by people is also increasing.

Modelling the area of land owned by each household shows that better off households own significantly more productive land than poorer households (Table 3), with the best off households owning 1 ha more on average than households of average BNS score. Similarly, households with older household heads and larger households were also found to own more productive land. Households that were engaged in commercial agriculture were found to have 0.75 ha more on average than households engaged in subsistence agriculture only. Households with outstanding debts were also found to have more land on average than households without debts. As 27% of surveyed households had outstanding loans from local microfinance institutions (MFIs) totalling \$358,000 US dollars, this result suggests that people may be taking advantage of available credit to expand the area they farm or are able to farm.

With respect to the spatial variation in household land use, people living in villages in the cash crop zone were found to have greater than average land holdings, whereas

people living in more remote villages in Sre Chhuk and Memong communes had less land than average (Figure 7).

Table 3: Coefficient estimates for the linear mixed model with log household land holdings as the response variable.

Variable	Estimate	Std. Error	Difference in area [ha]	t Value
(Intercept)	0.07	0.14	-	0.53
Standardised household size	0.23	0.04	0.27	5.48
Standardised BNS score	0.65	0.04	0.98	15.57
Standardised age of household head	0.16	0.04	0.19	4.13
Cash agriculture	0.53	0.13	0.75	4.12
In debt	0.14	0.04	0.17	3.47
Standardised number of cattle	0.20	0.04	0.23	4.58

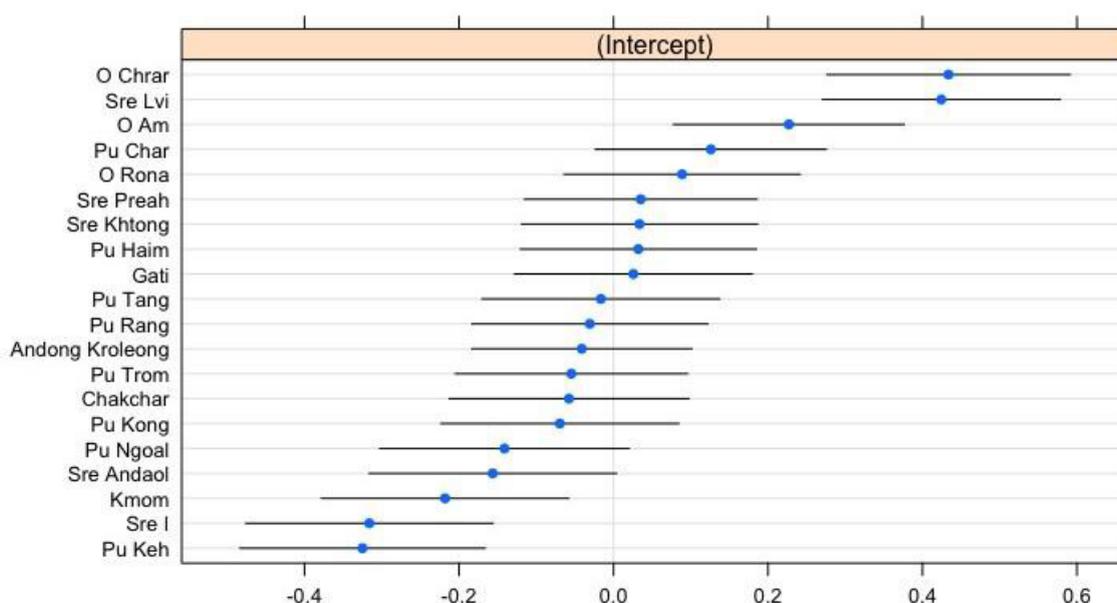


Figure 7: Spatial variation in log productive land owned by surveyed households.

Rice/Land Sufficiency

Indicator Description	Indicator Status/Trend	Additional Comments
Percentage of households with sufficient land to meet annual rice consumption needs.	Projected 80.3% of households across project area sufficient in rice or with sufficient land to be able to meet annual rice needs.	Average annual rice consumption 260kg per adult male equivalent.

One of the key indicators used to assess whether households have sufficient land is their ability to grow enough rice to feed themselves over the course of a year. Although there has been a significant shift towards the cultivation of cash crops in recent years, the prices offered to farmers are highly volatile as the markets are largely unregulated and farmers often find themselves at the mercy of unscrupulous middlemen. As such, there is a danger that farmers put themselves at risk of hunger if they do not earn enough to buy rice throughout the year. To monitor this risk, a second indicator, land sufficiency, was included in the social monitoring framework. This is calculated by taking a productivity of 1 t/ha of rice for *chamkar* fields (based on the average productivity and price for cassava cultivation, which shows that the expected net income from one hectare of *chamkar* is sufficient to buy one tonne of rice) and adding this to a household's rice production and subtracting their annual consumption of rice.

In 2012, 34.7% of households produced a rice surplus, while 34.2% did not produce any rice. In 2017, although 34.3% of households still did not produce any rice, the percentage of rice sufficient households grew significantly to 51.5%. Land sufficiency was also found to increase from a projected 70.2% of households across the landscape to 80.3% of households. This is another encouraging result as it suggests that food security is increasing across the project area as people's access to land increases.

THREATS TO PROJECT OUTCOMES

Threat 1: Population growth and immigration

Indicator Description	Indicator Status/Trend	Additional Comments
Project area wide growth rate in population and number of households.	Further data collection required	It is recommended that the KSWS community team be charged with the collection of population data.

Population growth and migration represent one of the greatest threats to the natural resources within KSWS. Under the social monitoring framework for KSWS, the number of households and total population of each village is collected as part of the five-yearly village survey conducted at the same time as the household survey. This was intended to be supplemented by a more in depth demography survey to be conducted every two years, for which data collection would be at the level of individual settlements. However, the demography survey has not been undertaken since 2010, making the five-yearly village level survey the sole source of population data for the 20 villages participating in the REDD+ project. Unfortunately, the reliability of this data is questionable, as it relies on the village chief keeping accurate records. As such it is very difficult to make reliable comparisons between survey years to calculate average annual growth rates.

In 2012, the annual growth rate in the number of households across the landscape was 7.1%. However, most of this growth was accounted for by just three villages (O Am, O Rona and Sre Preah). Excluding these three villages gave a much lower annual household growth rate of 3.8%.

The latest village survey in 2017 suggests that many of the villages inside KSWS that had previously had a lower rate of household growth have grown at a much faster rate over the period between 2012 and 2017. However, comparison of the data provided by the 2012 and 2017 surveys gives some unexpected trends that call into question the accuracy of the data. Hence, they have not been presented here and it is recommended that the community team at KSWS be given the responsibility for annual population data collection at settlement level.

Threat 2: Land alienation and legal conflict

Indicator Description	Indicator Status/Trend	Additional Comments
The main indicator of land alienation is the percentage of households with no productive land, with a secondary indicator of the number of households that report losing land to concessions.	The projected percentage of landless households increased very slightly from 8.7% in 2012 to 9.7% in 2017. 23 households reportedly lost land to ELCs.	Some households may be landless through choice or livelihood specialisation.

Land alienation as a result of ELCs or powerful individuals claiming land is potentially a serious issue in the project area and a threat to the project’s target of land sufficiency for local people. Since 2012, no new ELCs have been granted in the project area, but households continue to be affected by the activities of three ELCs granted in the buffer zone of KSWS. Similarly, as land pressure grows elsewhere in the country and migration of people from other provinces continues, there is a risk of powerful individuals claiming community land.

The projected percentage of households who owned no productive land in 2012 was 8.7% and this percentage has remained almost constant over the five years from 2012 to 2017, increasing slightly to 9.7%. This means that, although the absolute number of households with no land has increased across the landscape, the rate of increase is largely in line with overall population growth. It should also be noted that, while better off households are less likely to be landless, the households most likely to be landless in 2017 were those operating a village service, with at least one member in employment or in which the head of the household had received some education (Table B.7, Appendix B). This suggests that at least some households may be landless out of choice.

In total, 23 households reported losing land to ELCs or individuals between 2012 and 2017, with an average area of 2.2 ha lost per household. Although this represents a significant loss to those households and the number of households affected has doubled since 2012, it suggests that the risk of land alienation across the landscape remains low. However, of the 23 households that reported losing land, 17 households lived in villages located on the boundary with the three ELCs, suggesting a need to avoid further illegal expansion of these ELCs beyond the concessionary boundaries.

Threat 3: Weak traditional institutions and lack of voice

Indicator Description	Indicator Status/Trend	Additional Comments
Percentage of households that attended a village meeting in the past year.	Projected household attendance of village meetings is 56.8% of households across the project area.	The majority of meetings attended concerned matter related to conservation or agriculture.

Village meetings are a sign of a healthy civil society within project villages and individual engagement within that society. As such the percentage of households that attended village meetings over the course of the year preceding the household survey provides a useful measure for how engaged local people are within their communities. In 2012, 39.4% of household attended village meetings. This had increased significantly to 56.8% of households by 2017. Of those meetings attended, the two most commonly discussed topics were agriculture and conservation, which demonstrates the role of the project in engaging local people in civil society (Fig. 8).

Modelling the likelihood of having attended at least one meeting over the course of the previous year shows that none of the vulnerable groups identified in the monitoring framework were more or less likely to have attended a meeting (Table B.8, Appendix B).

This is a reassuring result, as it suggests that vulnerable groups are not being excluded from participating in village institutions or denied a voice. In total, 6.9% of households interviewed in 2017 held some form of position related to WCS activities. These households were found to be nearly three times more likely to have attended a village meeting than other households.

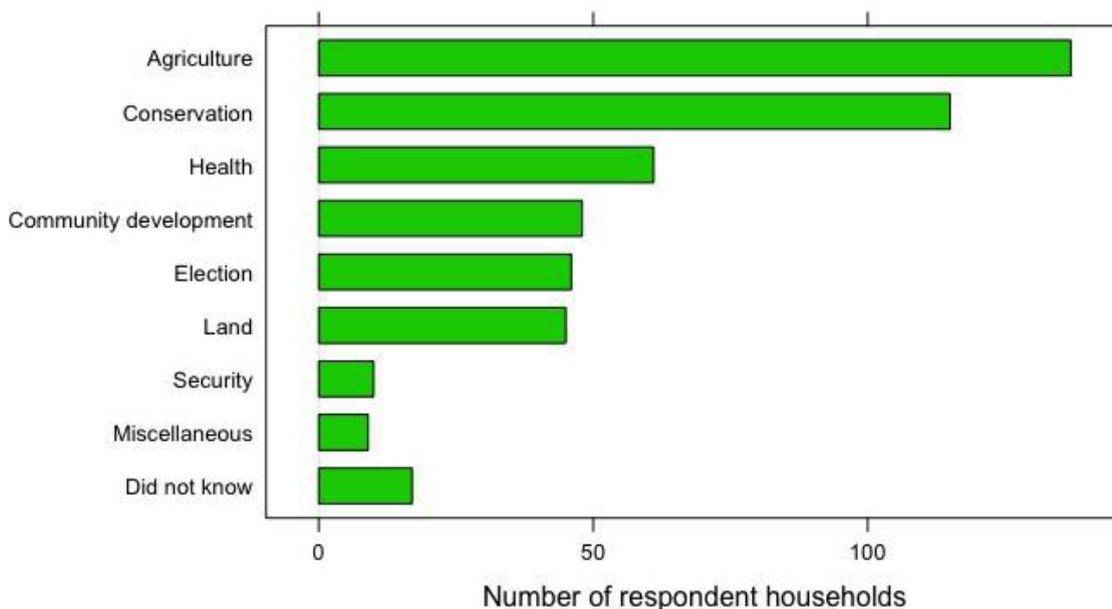


Figure 8: Number of households who had attended at least one village meeting in the year preceding the household survey in 2017.

Threat 4: Limited agricultural productivity

Indicator Description	Indicator Status/Trend	Additional Comments
Average productivity of cassava and rice fields.	Average agricultural productivity of 1.6 t/ha for rice and 1.8 t/ha for cassava.	Rice yields difficult to separate into paddy and upland varieties as respondents were prone to conflating the two.

Limited productivity is potentially a significant threat to improved livelihoods in KSWS. As commercialisation of agriculture increases across the landscape and land use practices change to adapt to this, there is a risk that productivity may fall if soil fertility is allowed to decrease. This is particularly a risk for cassava production where farmers use the same piece of land for multiple years in succession with little to no addition of nutrients to the soil.

While caution should be used in interpreting trends in crop productivity between years, as productivity depends on multiple factors, the results from the 2017 household survey suggest that cassava productivity has fallen across the landscape. In 2012, the average cassava yield for a hectare of cultivated land was 3.5 t/ha. In 2017, this had fallen to 1.8 t/ha. Hence, while the area of land in which cassava is being grown approximately doubled from 0.48 ha per household in 2012 to 0.80 ha per household in

2017, the reported yield remained nearly constant. This is reflected in the responses of the 91 households that reported their livelihoods had got worse between 2012 and 2017, with 15 households attributing this to reduced profitability of cassava. Unlike cassava, the productivity of rice remained relatively constant. In 2012, the average reported rice productivity was 1.6 t/ha, whereas this was 1.5 t/ha in 2017.

Threat 5: Scarcity of sustainable development, livelihood opportunities, on and off farm

Indicator Description	Indicator Status/Trend	Additional Comments
Percentage of households involved in off farm livelihood activities.	Projected 60.6% of households across project area involved in off farm livelihood activities.	Nearly all households surveyed (87%) are involved in the production of cash crops.

The proportion of households involved in off farm livelihood activities is an important indicator of sustainable development across the 20 project villages. Agricultural land is a finite resource and, while reserve land has been identified within each of the ICT areas and land use plans to allow for population growth, continued expansion of agricultural land holdings and immigration will threaten to constrain household livelihoods without diversification of livelihoods. As such, the proportion of households pursuing off farm income generating activities provides a measure of resilience to land constraints.

In 2012, 29.5% of households across the landscape were projected to earn at least some portion of their annual income through off farm activities. By 2017, this had increased significantly to 60.6% of households. This is encouraging as it suggests that fewer households are totally dependent on farm based livelihood activities. This is reflected in the finding that 87% of households surveyed in 2017 were involved in the production of cash crops. While still very high, this percentage has dropped from 100% of households in 2012, which provides further evidence that there may have been a slight shift away from agriculture based livelihoods.

Threat 6: Logging and Hunting

Indicator Description	Indicator Status/Trend	Additional Comments
Total number of households reporting income from illegal activities.	The percentage of households reporting income from illegal activities was 16.4% in 2017.	Income from logging represents a significant source of cash income for population.

Logging and commercial hunting are two of the biggest threats to biodiversity in KSWS. While it is not known how prevalent these illegal activities are within the local population, there has been widespread logging across the landscape in the five-year period from 2012 to 2017, with conflicting social impacts. On the one hand, illegal logging threatens resin trees, has been associated with increased drug use and security issues and acts to undermine traditional social structures within local communities. On the other, logging is a profitable activity that has most likely served to improve local livelihoods. Less is known about the prevalence or impact of commercial hunting.

Reported involvement and income from illegal activities are often unreliable as people are unwilling to give away information that may compromise themselves. As such, estimates derived from direct questioning and reporting are likely to be underestimates of the true situation. Similarly, it is difficult to interpret trends in these indicators, as changes in the sensitivity of different activities will affect the likelihood of accurate reporting by those engaged in that activity. Despite this, it is useful to track these indicators on the understanding that they represent a lower bound of reality.

In 2017, 102 households (16.4%) reported an income from illegal activity, with an average annual income per household of \$942 US dollars. The significant majority of these households (95%) were engaged in illegal logging, with the reported average earnings from logging found to be \$979 US dollars. These figures show that illegal activity is a major source of income across the landscape and is likely to be a contributing factor to the improved economic status observed for households living in the REDD+ villages. It is also notable that five households attributed their perceived negative trend in their livelihood to declining availability of timber.

Threat 7: Household Debt

Indicator Description	Indicator Status/Trend	Additional Comments
Total outstanding loans to microfinance institutions and proportion of households with outstanding loans.	The percentage of households with outstanding loans increased from 8.4% in 2012 to 27.1% in 2017. Total debt to MFIs rose from \$32,000 to \$358,000 in 2017.	Risk that debt will fuel engagement in illegal activity, particularly if cash crop profitability declines.

Household debt has increased significantly since 2012. The emergence of microfinance institutions (MFIs) has enabled local people to access credit in a manner that was not previously open to them. In 2012, 52 surveyed households (8.4%) reported outstanding loans with an MFI, with these loans totalling \$32,000 US dollars. In 2017, 27.1% of surveyed households had an outstanding loan with an MFI, with the outstanding total of these debts an order of magnitude higher than in 2012 at \$358,000 US dollars. In some cases, individual households were found to have taken out multiple loans.

The concern with this level of debt is that people will be forced to default if they receive a poor harvest or if someone in the household falls sick. In many cases, people have used land titles as collateral for the loans, which threatens to increase land alienation. This also potentially has implications for community land, as this remains state land and should not be used as collateral, and for law enforcement efforts, as people may be tempted to turn to illegal activities to pay back loans. Understanding how households are accessing loans and paying them back will therefore be of increasing importance over the next five years. This level of indebtedness is also of concern to local people. Of the 91 households who felt that their livelihoods had got worse over the previous five years, 13.2% of households cited outstanding loans as the reason.

CONCLUSION

The results of the household survey show that there is much to be positive about regarding social change in the 20 participating REDD+ villages for the period between 2012 and 2017 (Table 4). Household economic wellbeing, access to land and livelihood diversification all showed positive trends. Similarly, key threats to social outcomes, such as weak local institutions and a lack of voice and a reliance on farm-based livelihoods, were found to have declined over the assessment period. All of these trends show a net benefit relative to those projected for the no project scenario.

Table 4: Table of indicators plus projected trends for the no project scenario and trends found in 2017. DD refers to data deficiency. Projected trends under the no project scenario are described in greater depth in Appendix C.

Category	Indicator	No Project Trend	2017 Trend
Economic wellbeing	Average household BNS score.	↓↑	↑
Natural resources	Resin tree ownership	↓	↓
	No. of resin trees owned	↓	↑
	No. of resin trees lost	↑	↑
	NTFP collectors	↓	↑
	Reported income from NTFP collection	↓	↓
	Wild meat meals consumed	↓	↑
Land use	Average land holdings	↓↑	↑
	Rice sufficiency	→	↑
	Land sufficiency	→	↑
Threats	Population growth	↑	DD
	Land alienation	→	→
	Lack of voice	↑	↓
	Limited agricultural productivity	↑→	↑
	Scarcity of off-farm livelihoods	→	↓
	Household debt	↑	↑

The picture is more mixed with regard to access and security of key natural resources. The decline in resin tree ownership is a sign that the project has not been fully successful in ensuring local people's continued access to natural resources important to their livelihoods. Similarly, the decline in agricultural productivity and increasing household debt suggests that some threats to the project's social targets are increasing. However, the trends in all three of these indicators are expected to have been similar or worse under the no project scenario.

Overall, while project performance as measured against some indicators has not met projections for the with-project scenario, all indicators show an improved (9 indicators) or similar performance (four indicators) to that expected under the no project scenario. As such, the survey findings suggest that the project continues to have a net positive impact on households (including those belonging to vulnerable groups) living inside each of the 20 villages participating in the REDD+ project.

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Appendix A: Household Questionnaire

Interviewer: _____ Tel. of respondent _____

Name of respondent _____ Sex _____ Age _____

Krom: _____ Village: _____ Commune: _____

District: _____

Note: Interviews should be conducted with the household head or household head's spouse.

1. Household Demographics

*First in list should be the interviewee. List all members of the household. For the purposes of this survey a household should be an **economic unit**. i.e. a group of people that share their wealth. A household could be more than one family, e.g. newly married children may stay in the same household as their parents and not travel.

1.1. *How many members in your household?.....Female.....Male.....*

N o	Name [in Khmer]	Age	Sex M/ F	Education [#yr]	In Education (Grade)	Function in HH (Code A)	Family Status (Code B)	Literate (Yes/No)	Ethnicity
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Code A: 1=Household head 2=HH head spouse 3=Children
4=Children-in-law 5=Parents 6=Relatives

Code B: 1=Married 2=Single 3=Widow/widower 4=Divorce

1.2. *When did your family settle in/return to this village? _____ From where: _____*

Reason for coming: _____

- 1.3. When was your household formed (ie when did you become head of household or household head's spouse)? _____
- 1.4. Do you or anyone else in your household hold a position of responsibility in the village?
 yes no If yes specify: _____
- 1.5. Do you or anyone else in your household hold a position of responsibility with WCS?
 yes no If yes specify: _____
- 1.6. Have you or anyone else in your household attended the training on law or regulation?
 yes no If yes specify: _____

2. Physical Capital

2.1. Residential land: _____m² (Width _____m x Length _____m)

2.2. When was your house built?

2.3. Did you build your house? Build yourself Inherit Buy

2.4. What is the size of your house? _____m² (Width _____m x Length _____m)
 How many rooms do you have in your house? _____rooms

2.5. What land did your household used to grow crops on last year? [**Answer in table**]

**If multiple plots list all. Yield data to be collected in most appropriate units (eg number of rice sacks (bay) for rice yields or kg for cassava). Sizes of all units should be checked locally. Remember to ask about fallow land that may not be under current cultivation but which the household have customary ownership rights over. If land was bought or is rented, record the price paid. If a gift or inheritance, record the person who gave it.*

No	Kind of land (code A)	W (m)	L (m)	Land size (m ²)	Year land claimed	Land inside ICT	Kind of crop	Access to land (Code B)	Yrs growing current crop	Previous crop (last season)	Fertility (Code C)
1											
2											
3											
4											
5											
6											
7											
8											

Code A: 1= Cropping on residential land 2= Non-rice Chamkar land

3= Rice Chamkar land 4=Rice land 5=Fallow

Code B: 1=Cleared 2=Bought 3=Rent in

4=Rent out 5=Inherited 6=Gift

Code C: 1=Excellent 2=Good 3=Poor 4=Depleted

2.6. *If there is no cash crops in the table above, what are the reasons your household doesn't grow them?* _____

2.7. *Did you buy any land during the last 5 year?* Yes No

If yes, what size? _____m² (Width _____m x Length _____m)

What price? _____riel

2.8. *Did you sell any land during the last 5 year?* Yes No

If yes, what size? _____m² (Width _____m x Length _____m)

What price? _____riel. What was the land used for by your household before the sale? _____

2.9. *Did your household receive land title during Prime Ministerial Order 001?*

If yes, what size? _____m² (Width _____m x Length _____m)

2.10. *Has your household been affected by any companies or any individual claiming your land in the last 5 years?*

yes no If yes, how much did you lose: _____

2.11. *Has your household been affected by any companies or any individual claiming your resin trees in the last 5 years?*

yes no If yes, how many did you lose: _____

2.12. *How many livestock does your household own? [Answer in table]*

No	Livestock	No. Owned	No. Sold last year	Price [riel]
1	Cows	heads	heads	
2	Buffalo	heads	heads	
3	Pigs	heads	heads	
4	Chicken (>0.5kg)	heads	heads	
5	Duck (>0.5kg)	heads	heads	
6	Muscovy (>0.5kg)	heads	heads	
7	Other:	heads	heads	
8	Other:	heads	heads	

2.13. *Of the cows/buffalo, how many can be used to plough?* _____heads

2.14. a- *How many resin trees does your household own?* _____

b- *How many resin trees does your household tap?* _____ **[Answer in table]**

No. of trees in group	Length of trip	Yield in DS [kan/trip]	Trips/month x Month (dry season)	Yield in WS [kan/trip]	Trips/month x Month (wet season)	No. of months not collected
	days	kan				

	days	kan				
	days	kan				
	days	kan				

2.15. What is the price did you sell your resin during in last year (April 2016 – March 2017)?

_____riel/kan (general average) (Min: _____riel/kan Max: _____riel/kan)

2.16. Did you buy any resin trees in last 5 years (April 2012 – March 2017)?

Yes If yes, how many? _____trees What was the price paid (total)? _____riel

No

2.17. Did you sell any resin trees in last 5 years (April 2012 – March 2017)?

Yes If yes, how many? _____trees What was the price paid (total)? _____riel

No

3. Income

3.1. Does anyone in your household have a job? [**Answer in table**] Yes No

Name (code)	Job title	With which type of agency?			Where	Salary [riel/month]	No. of months worked/year
		<input type="checkbox"/> NG O	<input type="checkbox"/> Publ ic	<input type="checkbox"/> Priv ate			
		<input type="checkbox"/> NGO	<input type="checkbox"/> Public	<input type="checkbox"/> ate			
		<input type="checkbox"/> NGO	<input type="checkbox"/> Public	<input type="checkbox"/> ate			
		<input type="checkbox"/> NGO	<input type="checkbox"/> Public	<input type="checkbox"/> ate			
		<input type="checkbox"/> NGO	<input type="checkbox"/> Public	<input type="checkbox"/> ate			

* Code in household demographic

3.2. Does anyone in your household sell their labour? [**Answer in table**] Yes No

Name (code)	Purpose of labour	Wage [riel/day]	No. of days worked /dry season	No. of days worked /wet season	Where do they work?

* Code in household demographic

3.3. Does your household operate any of the following services within the village? **[Answer in table]** *The data reported here will be used to collect NET profits, not gross incomes. If respondents are unclear help them first, for each service, to estimate the capital costs, such as buying wine making equipment or a generator, and operational costs, such as labour costs, fuel costs and input costs (eg ingredients for making rice wine or shop stock).

No	Service	Yes/No	Capital costs (Start-up) [riel]	Gross income [riel/year]	Operational costs [riel/year]	Net income [riel/year]
1	Village shop	<input type="checkbox"/> yes <input type="checkbox"/> no				
2	Rice threshing service	<input type="checkbox"/> yes <input type="checkbox"/> no				
3	Rice milling service	<input type="checkbox"/> yes <input type="checkbox"/> no				
4	Produce rice wine	<input type="checkbox"/> yes <input type="checkbox"/> no				
5	Karaoke shop	<input type="checkbox"/> yes <input type="checkbox"/> no				
6	Video service	<input type="checkbox"/> yes <input type="checkbox"/> no				
7	Generate electricity / charge battery	<input type="checkbox"/> yes <input type="checkbox"/> no				
8	Resin trader	<input type="checkbox"/> yes <input type="checkbox"/> no				
9	Cassava trader	<input type="checkbox"/> yes <input type="checkbox"/> no				
10	Cashew trader	<input type="checkbox"/> yes <input type="checkbox"/> no				
11	Rubber nursery	<input type="checkbox"/> yes <input type="checkbox"/> no				
12	Blacksmith	<input type="checkbox"/> yes <input type="checkbox"/> no				
13	Mechanic	<input type="checkbox"/> yes <input type="checkbox"/> no				
14	Carpenter	<input type="checkbox"/> yes <input type="checkbox"/> no				
15	Rent buffalo for ploughing	<input type="checkbox"/> yes <input type="checkbox"/> no				
16	Rent koyun for ploughing	<input type="checkbox"/> yes <input type="checkbox"/> no				
17	Moto service	<input type="checkbox"/> yes <input type="checkbox"/> no				
18	Other.....					

3.4. What did your household earn from selling agricultural produce in the last 12 months (April 2016 – March 2017)? **[Answer in table]***As with the income from operating village services, respondents may need to be helped to estimate the labour and other operational costs involved in the cultivation (eg. ploughing service, seeds, fertilisers/pesticides). Crops should be estimated **for all crops**, even if the household did not sell.

No	Kind of Crop	Total production (in Kg)	Price [riels/Kg]	Gross incomes (Riel)	Total costs [riels/ha]	Net incomes	Where did you sell (code)?
1	Paddy rice						
2	Chamkar rice						
3	Cashew nut						
4	Cassava						
5	Rubber						
6	Vegetable						
7	Beans						
8	Fruits						
9	other (specify) _____						
10	other (specify) _____						

Code : 1=Inside village 2=At market (specify) 3= Outside village

3.5. What did your household harvest from the forest in the last month/last 12 months (April 2016 – March 2017)? **[Answer in table]** *This table can include any forest product, including timber and wildlife. **If there is a moto or truck equipped for carrying timber, ask about earnings from logging.**

No	Forest product	Amount collected [units/trip]	# trips last year	Price [riels/unit]	Gross incomes [riels/year]	Total cost involved [riels/year]	Net incomes [riels/year]	Average distance to harvest
1	Resin tree							
2	hard resin							
3	rattan							
4	bamboo							
5	mushrooms							
6	vine/liana							
7	wild vegetable							
8	wild fruit							
9	Honey							
10	other(specify) _____							

11	other(specify) _____							
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Code A: 1= Home consumption 2=Inside village 3= At market (specify) 4= Outside village

3.6. Does the forest provide you with any other benefit? Yes No

If yes, please specify: _____

3.7. A- Which three agricultural (crops and livestock) or forest products are most important for your household's development? **[Answer in blank: a, b and c]** * From the above tables of Forest Products in question 3.5, Kind of Crops in question 3.4, and livestock in question 2.12, consult with the respondent to identify 1 to 3 priority products, which are the main income for the family or livelihood development.

a. Commodity:....., b. Commodityc. Commodity:

B- What are the main problems and opportunities that your household faces for these products? **[Answer in table]** * From the answer in question 3.6, identify problems and opportunities of the household in earning income from those commodities.

No.	Name of commodities (from the above answer in question 3.6)	Problems	Opportunities
1	a.	1- 2- 3-	1- 2- 3-
2	b.	1- 2- 3-	1- 2- 3-
3	c.	1- 2- 3-	1- 2- 3-

3.8. Do you receive any money from relatives/friends? Yes No

Relationship of providers to household	Amount received [riel]	Frequency received

4. Consumption

4.1. How much rice does your household cook per day? _____ Kg/day

4.2. How many months was your household able to eat rice from your production last year (April 2016 – March 2017)? _____ months

4.3. Was this more than, the same as or less than the typical year? More The same Less

4.4. How much milled rice did your household donate (to relatives/neighbours/pagoda) in the last 12 months (April 2016 – March 2017)? _____ kg

4.5. In the past 5 years, how many years has your household needed to borrow milled rice? ____ yrs

4.6. How much does your household spend on the following items? [Answer in table]

Expense		Last Week [riel]	Last Month [riel]	Last 12 months [riel]
Rice (for consumption)				
Non-rice food (purchasing for consumption)	meat			
	fish			
	vegetable			
	fruit			
	Condiment			
clothing				
fuel/transport				
electricity				
school fees				
medical fees				
agricultural inputs (eg seeds)				
building materials/repairs				
weddings/ceremonies				
Other (specify) _____				

4.7. How many times did you eat meat and fish in the last week?

	Domestic animal	Wildlife
Eat meat	_____/21 meals	_____/21 meals

	From own harvest	Purchasing
Eat fish	_____/21 meals	_____/21 meals

5. Loan

5.1. Does your household currently have an outstanding loan? Yes No **[If yes, answer in table]**

Loan sources	Amount of loan	Payment methods (Code A)	Amount outstanding	Unit	Loan cycle (month)	Interest rate % in month	When did you borrow?
Saving group							
Rice bank							
Private money lender							
Resin traders							
Relatives/neighbours							
MFI.....							
.....							

Code A: 1-Some loan principle and interest in each moth, 2-Only interest each month 3- Both interest and loan principle at the end of cycle 4-Others

5.2. Does your household debts from last 12 months? Yes No **[If yes, answer in table]**

Loan sources	Amount of loan	Unit	Loan cycle (month)	Interest rate % in month	Since when did you completely pay off?
Saving group					
Rice bank					
Private money lender					
Resin traders					
Relatives/neighbours					
MFI.....					
.....					

5.3. If yes (for question 5.1.), what were the three main purposes of taking the loan?

<input type="checkbox"/> To buy farm or other tools/implements	<input type="checkbox"/> To buy food/goods for the HH
<input type="checkbox"/> To buy inputs such as seeds/fertilizers/pesticides	<input type="checkbox"/> To pay for building materials
<input type="checkbox"/> To buy livestock	<input type="checkbox"/> To pay for health expenses
<input type="checkbox"/> To pay for hired labour	<input type="checkbox"/> To pay for education expenses
<input type="checkbox"/> To buy land	<input type="checkbox"/> To pay for debt

<input type="checkbox"/> To pay rent/taxes	<input type="checkbox"/> For wedding
<input type="checkbox"/> To start or additionally equip an off-farm business	<input type="checkbox"/> Support migration of a relative
<input type="checkbox"/> For funeral	<input type="checkbox"/> Other, please specify:.....

6. Attitudes/Perceptions

6.1. *Has your household's livelihood improved over the last 5 years?*

Improved Stayed the same Got worse

What are the main reasons for these changes? _____

6.2. *How has the way your household uses your own-land changed over the last 5 years?*

What are the main reasons for these changes? _____

6.3. *Do you feel that there is sufficient labour available in your household to farm as much land as you want to?* Yes No

6.4. *Do you feel that there is sufficient labour available to your household to farm as much land as you want to (ie are you able to hire enough labour as you need)?* Yes No

6.5. *How secure do you feel about your land?*

Strongly secure Fairly secure Less secure Not secure

Why do you feel this way? _____

How have your feelings changed over the last 5 years?

More secure The same Less secure

6.6. *Have your feelings about the security of your land tenure changed since the indigenous land titling?* Yes No

If yes, how have they changed? _____

6.7. *How secure do you feel about your resin trees?*

Strongly secure Fairly secure Less secure Not secure

Why do you feel this way? _____

How have your feelings changed over the last 5 years? _____

More secure The same Less secure

6.8. Have your feelings about the security of your resin trees changed since the ELCs were granted? Yes No

If yes, how have they changed? _____

6.9. Does cutting trees provide benefits to your household? yes no

If yes, how? _____

6.10. Have you attended any village meetings in the last year (April 2011 – March 2012)?

yes no If yes, what was it about? _____

6.11. In general, what do you think about cooperation between people in the village?

6.12. Do local leaders consider your concerns when they make decisions that affect you?

yes no If yes, how? _____

6.13. Out of the following options, rank the most important infrastructure challenge in your village (1 is most important, 5 is least important)

__ Road improvement

__ Drinking water

__ Irrigation for agricultural land

__ Electricity

__ Buildings for community

Other _____

Why did you choose number 1? _____

6.14. What are the positives of good roads? _____

6.15. What are the negatives of good roads? _____

6.16. Do you prefer to have a good road or not? yes no

7. Basic Necessity

“Basic necessities are the minimum requirement for living that all households of the community should have and no-one should not have.”

No	Type of basic necessity	Is it a necessity?	Does your HH have it?	Quantity
1	Having at least one week holiday per year for all family members for tourist to visit other provinces or tourist site (e.g. Siem Reap) (do not include visiting relative)			

No	Type of basic necessity	Is it a necessity?	Does your HH have it?	Quantity
2	Having three meals per day regularly: Breakfast, Lunch and Dinner for all family members			
3	Having gas-cook stove (with two stoves using with large gas containers - 14.7Kg)			
4	Having Cassette Recorder/Player (or VCD)			
5	Having mosquito net for all family members			
6	Having health insurance for all family members			
7	Having ability to participate in all invited wedding in your community			
8	Having car battery 40 A or more (for lighting and/or watching television)			
9	Having at least two big cattle (buffalos or cows) for farming or pulling cart			
10	Having at least one water jar for keeping water for consumption (at least 120 L Jar)			
11	Having a fan using electricity in the family			
12	Having access to electricity (from public or generator service own generator)			
13	Having thick blanket for all family members			
14	Having at least one long knife			
15	Having a motor-trailer (Kor Yun)			
16	Having a fridge (not cooler box)			
17	Having at least one axe			
18	Having hand pump well at home			
19	Having home-toilet connecting with sewer or septic tank			
20	Having one wooden wardrobe in the family			
21	Having access to a car-taxi service from village to district or provincial town?			
22	Having one motorbike in the family			
23	Having roof with zinc sheet / Tile roof/ fibro house			
24	Having wooden wall house			
25	Having a television			
26	Having a washing machine using electricity			

No	Type of basic necessity	Is it a necessity?	Does your HH have it?	Quantity
27	Having a mobile phone			
28	Having homestead land at least 50m x 100 m or 5000m ² (settlement land with home garden around)			
29	Having farming land for rice cultivation or doing Chamkar at least 3 ha?			
30	Having a concrete house			
31	Having access to water supply system (arriving at home)			
32	Having ability to send children to school at least grade 9			
33	Having ability to contribute in all traditional ceremonies in community			
34	Having an electric rice cooker			
35	Having capacity to buy two sets of new clothes for all family members each year			
36	Having plastic tent for camping in the forest			
37	Having a hammock with mosquito net			
38	Having an ox-cart for carrying agricultural products and fire wood...etc.			
39	Having a grass cutting machine			
40	Having a kettle for boiling water in the family			

Appendix B: Model tables

Table B.1: Coefficient estimates for the linear mixed model with household BNS score (2012 weightings) as the response variable.

Variable	Estimate	Std. Error	t Value
Intercept	13.11	0.49	26.71
2017 dummy	2.67	0.39	6.78
Indigenous household	-0.56	0.35	-1.63
Resin tree owner	0.66	0.26	2.56
ln(land holdings +0.0745)	1.05	0.08	13.59
Shop owner	1.08	0.29	3.70
Labour seller	-1.72	0.18	-9.82
Female headed household	-1.00	0.28	-3.62
Educated household head	0.74	0.18	4.08
Off-farm livelihood	0.97	0.21	4.56
2017 : Indigenous household	0.62	0.42	1.46
2017 : Resin owner	-0.98	0.40	-2.44

Table B.2: Coefficient estimates for the generalised linear mixed model with resin tree ownership as the response variable.

Variable	Estimate	Std. Error	Probability	Diff in Probability	P value
Intercept	-0.91	0.32	0.29	0.00	0.005
2017 dummy	-1.86	0.25	0.06	-0.23	0.000
NTFP collector	0.30	0.20	0.35	0.06	0.131
Indigenous household	1.26	0.24	0.59	0.30	<< 0.001
Standardised household size	0.72	0.15	0.45	0.16	<< 0.001
Employed	-0.40	0.23	0.21	-0.08	0.074
Labour seller	-0.45	0.15	0.21	-0.08	0.004
Landless household	-0.75	0.35	0.16	-0.13	0.030
2017 : NTFP collector	0.53	0.31	0.41	0.12	0.089

Table B.3: Coefficient estimates for the linear mixed model with the number of resin trees owned by resin tree owning households as the response variable.

Variable	Estimate	Std. Error	t Value	No. Trees	Diff in Trees
Intercept	4.14	0.08	52.83	93	0
2017 dummy	0.39	0.09	4.59	137	44
Landless household	0.79	0.22	3.50	204	111

Table B.4: Coefficient estimates for the generalised linear mixed model of the probability a household lost resin trees to illegal logging between 2012 and 2017.

Variable	Estimate	Std. Error	Probability	Diff in Probability	P value
Intercept	-4.51	0.44	0.19	0.00	<< 0.001
2017 dummy	1.67	0.26	1.02	0.82	<< 0.001
Indigenous household	0.77	0.34	0.41	0.22	0.024
Landless household	-1.16	0.63	0.06	-0.13	0.066
Standardised household size	0.52	0.21	0.32	0.13	0.014
NTFP collector	0.50	0.22	0.32	0.13	0.024

Table B.5: Coefficient estimates for the generalised linear mixed model of the probability a household collected resin for home consumption or sale.

Variable	Estimate	Std. Error	Probability	Diff in Probability	P value
Intercept	-2.40	0.36	0.11	0.00	<< 0.001
2017 dummy	1.11	0.14	0.28	0.16	<< 0.001
Indigenous household	0.60	0.18	0.19	0.07	0.001
Resin tree owner	0.50	0.15	0.17	0.06	0.001
Labour seller	0.80	0.13	0.22	0.11	<< 0.001
Cash crop grower	0.55	0.28	0.18	0.07	0.052
Employed	-0.59	0.19	0.06	-0.05	0.002
Shop owner	-0.42	0.21	0.08	-0.04	0.050
Adult male equivalent	0.07	0.03	0.12	0.01	0.035

Table B.6: Coefficient estimates for the generalised linear mixed model with the proportion of wild meat meals consumed per week as the response variable.

Variable	Estimate	Std. Error	P value
Intercept	-2.00	0.07	<< 0.001
2017 dummy	0.81	0.06	<< 0.001
Standardised BNS score	-0.73	0.06	<< 0.001
Standardised household size	0.37	0.05	<< 0.001
In debt	-0.32	0.06	<< 0.001
NTFP collector	0.38	0.05	<< 0.001
Female headed household	-0.79	0.010	<< 0.001
Resin tree owner	0.36	0.04	<< 0.001
Educated household head	0.09	0.03	0.015
Service provider	0.15	0.06	0.005
Labour seller	-0.17	0.03	<< 0.001
2017 : Standardised BNS score	0.81	0.08	<< 0.001
2017 : Standardised household size	-0.54	0.07	<< 0.001
2017 : In debt	0.82	0.07	<< 0.001
2017 : NTFP collector	-0.43	0.07	<< 0.001
2017 : Female headed household	1.29	0.12	<< 0.001

Table B.7: Coefficient estimates for the generalised linear mixed model of being landless.

Variable	Estimate	Std. Error	Probability	Diff in Probability	P value
Intercept	-3.35	0.29	0.03	0.00	<< 0.001
Standardised household size	-0.94	0.31	0.01	-0.02	0.003
Standardised years in village	-1.49	0.22	0.01	-0.03	<< 0.001
Standardised BNS score	-1.62	0.26	0.01	-0.03	<< 0.001
Resin tree owner	-0.69	0.33	0.02	-0.02	0.036
Employed	0.88	0.31	0.08	0.04	0.005
Service provider	0.87	0.34	0.08	0.04	0.009
Livestock seller	-1.13	0.39	0.01	-0.02	0.003
Educated household head	0.63	0.27	0.06	0.03	0.021

Appendix C: Summary of the conceptual model, projections and indicators

	Projection without project	Impacts on	Projection with project	Indicator (Quant)	Method*	Indicator (Qual)	Method*
<i>CCB Core Standards</i>							
Social and economic well-being of communities; distribution of costs and benefits	Static or decline for vulnerable stakeholders; improve for less vulnerable stakeholders	Primary impact on vulnerable stakeholder groups	Improving for all stakeholder groups, including vulnerable groups	Basic Necessities Survey, basket of assets and income measures for each stakeholder group	HHS	Reported trends	Partic.
Net positive impacts on biodiversity	Severe declines with extinction of many vulnerable species	Biodiversity values, users of biodiversity, forest health	Biodiversity values increasing, return to natural levels	Index based on forest cover and wildlife population trends	Synthesis of target data	-	
Conceptual Model Target							
Maintain the variety, integrity, and extent of all forest types	Declining extent and quality of all vegetation types	Carbon stocks, biodiversity values; livelihoods of vulnerable stakeholders	Stabilized cover of natural vegetation, improving quality	Forest cover monitoring and other parameters required for carbon accounting	GIS		
Increase populations of wildlife of conservation concern	Declining populations of most globally threatened species	Global public goods; cultural losses; dietary contribution; ecotourism projects; health of forest ecosystem	Populations increased to carrying capacity	Population sizes for 4-6 target species	transect surveys and dung DNA	Presence and distribution	Sightings, camera-trapping
Increase security and productivity of natural resources to support local livelihoods	Declining security, abundance and productivity of harvested natural resources and availability of clean water	Especially on vulnerable stakeholders	Security, abundance and productivity of key resources maximised; clean water freely available to all communities	total resin tree ownership, reported harvest levels of other forest products and fish	HHS	Reported trends	Partic.
Sufficient farmland to support the livelihoods of current residents	Increase in landlessness, static or decreasing agricultural productivity	Especially on vulnerable stakeholders	Landlessness among the poor low and stable; agricultural productivity and sustainability increasing	land ownership measures (% landless, % long-term landless; ave holdings); rice sufficiency	HHS, +LNGOs	Reported trends	Partic., LNGOs

Conceptual model threat							
Clearance for land concessions and other projects	Increasing loss to concessions	Especially on vulnerable stakeholders	Losses to concessions minimised and halted	Mapping of affected areas	GIS	Reported trends	Partic.
Undefined borders and regulations for the SPF	Continuing weaknesses in protection	Especially on vulnerable stakeholders	Borders, zones and regulations clearly defined and enforced	Mapping of demarcation, legal documentation	GIS	-	-
Population growth, in-migration, better access	Continued high in-migration, increased competition; increased conflict	Especially on vulnerable stakeholders	Population growth lower than in reference area; net in-migration negligible; access to forest areas fully controlled	Net in-migration negligible; access system excludes non-legitimate users	HHS, Demog	Reported trends	Partic.
Forest clearance/grabbing by individuals; over-fishing, over-hunting of wildlife; illegal logging and overexploitation of NTFPs	Widespread over-harvesting /clearance	Especially on vulnerable stakeholders	Illegal activities (clearance, hunting, over-fishing, hunting, logging, NTFP harvest) at very low levels	Patrol information (MIST system), independent surveys (e.g. snares, stumps), Defor mapping	WCS/FA	Reported trends	Partic.
Land alienation and legal conflict	Alienation, forced sales, Uncertain tenure due to expansion outside agreed land-use plans	Especially on vulnerable stakeholders	Land alienation ceases, no land illegally occupied and subject to conflict	# of reported incidents	HHS, systematic recording of conflicts and legal tenure	Reported trends	Partic.
Weak traditional institutions and lack of voice	Seriously declined	Especially on vulnerable stakeholders	Traditional and new community institutions effective, cultural cohesion improved	Levels of involvement	HHS, committee records	CBO effectiveness self-assessment	Partic.
Limited agricultural productivity	Decline, stagnation or slow improvement	All onsite communities	Agricultural productivity increasing	Agricultural productivity indicators (e.g. t/ha)	HHS (all HH); LNGOs (target families)	Reported trends	LNGOs
Scarcity of sustainable dev. livelihood opportunities, on/off farm	Continued dependence on limited number of often unsustainable livelihoods	All onsite communities	Increasing diversity of viable, sustainable livelihood opportunities	# of liv activities; size of reported income sources	HHS (all HH); LNGOs(target families)	Reported trends	LNGOs
Climate change	Difficulty adapting to changes in availability of wild-harvested resources and	Especially on vulnerable stakeholders	Increased capacity to adapt to climate-driven changes	-	-	Reported trends	Partic., LNGOs

	productivity of farming systems						
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*Method:

HHS = Household survey Demog = Rapid demography survey LNGOs = Local NGOs' own monitoring Partic. = WCS/FA-led consultation workshops
 GIS = Mapping approaches such as remote sensing

Note: table includes both social and biological indicators, for completeness