

KEY MESSAGES

- Agriculture is the main livelihood activity in Yangambi but its economic value is very low, due to low yields and soil fertility constraints.
- Despite being increasingly difficult to access, forest resources—especially bushmeat—are fundamental to local diets and livelihoods.
- Food insecurity in Yangambi is a factor of food quantity and quality; throughout the year, a quarter of the households experience food shortages and more than a third have diets below/bordering the necessary diversity levels.
- Despite being educated, households in Yangambi—including the wealthiest ones—live below the poverty line, suggesting little availability of income generating opportunities.
- The area around Yangambi presents significant potential for agroecological intensification to increase food security, agroforestry systems to diversify diets and value chain development to increase incomes.



Livelihoods of households living near Yangambi Biosphere Reserve, Democratic Republic of Congo

Introduction

Forests in the Democratic Republic of Congo (DRC) cover more than 100 million hectares (ha), are home to thousands of plant and animal species, and regulate continental scale water cycles and global climate change [1]. Nearly 40 million people live in or near these forests. They are amongst the poorest and most vulnerable globally, despite the wealth of natural resources around them. Increasing demand for food, shelter, energy and income contributes significantly to deforestation and forest degradation [2] and links critical development and environmental challenges with local and global implications. The

future of DRC's Forests depends on creating pathways out of poverty for those living around and within the forests while sustainably managing resources.

The DRC has many protected forest areas; some are as large as European countries. The Salonga National Park, for example, crosses an area greater than Belgium. The Yangambi Biosphere Reserve (YBR), established in 1976 and located in Tshopo Province, covers 235,000 ha and includes flora and fauna characteristic of tropical rainforest of DRC. During the colonial period, the Belgians set up a tropical agriculture and ecology research station



Formation, Recherche
et Environnement
dans la Tshopo



adjoining it, which persists today. With an increasing number of people living around and within the reserve, Yangambi represents a microcosm of conservation and development concerns pervasive throughout DRC today.

This brief presents findings from an assessment of rural livelihood systems around the reserve. The assessment was undertaken to identify entry points to create wealth, improve nutrition and conserve the forest. It aims to develop a contextual understanding of rural communities and offer a localized frame for development action, by using a cost-effective and integrative household appraisal tool, known as the Rural Household Multi-Indicator Survey (box 1). The narrative is structured around key components of livelihood and farming systems: demographic characteristics and decision-making, farming activities, forest resources, food and nutrition security; and household wealth and wellbeing.

These insights serve as touchstone for identifying and planning locally-relevant development investments, as well as for monitoring and evaluation of interventions in the area.

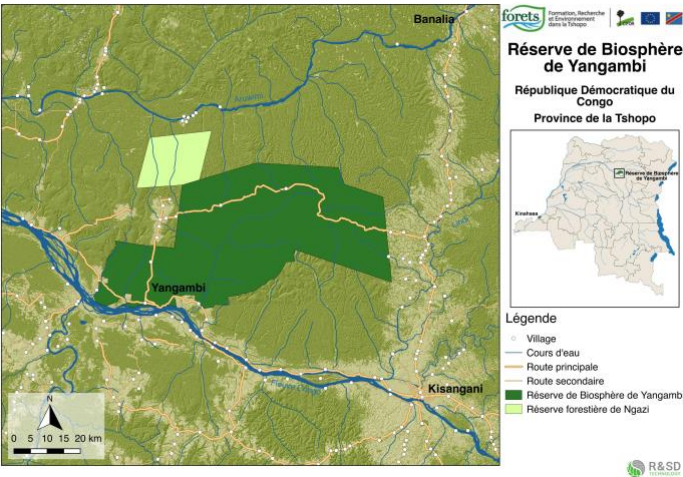


Figure 1 Location of the Yangambi Biosphere Reserve.

Box 1. Rural Household Multi-Indicator Survey (RHoMIS) around Yangambi Biosphere Reserve

RHoMIS characterizes households and farming systems in rural landscapes. It was designed in response to the needs of development practitioners to conduct rapid, cost-effective, reliable and comparable socioeconomic baselines that could feed into programming, performance monitoring and evaluation and would increase learning opportunities across projects and sites. The survey captures information on more than 20 indicators referring to farm productivity and practices, nutrition, food security, gender equity, climate and poverty. As the survey is modular, indicators can be added and/or adapted to fit the local context or project needs. For example, the team is developing a new social connectivity module to understand the connections between people and institutions, which is an important driver of social resilience in some vulnerable populations. The questionnaire takes around 40-60 minutes and is available in eight languages: Arabic, English, French, Hindi, Khmer, Kiswahili, Kinyarwanda, and Spanish. Until now, the tool was tested and adapted in 19,465 interviews in 27 countries. For more details, check: <https://www.rhomis.org/>.

In DRC, 413 households were interviewed along the main axes surrounding the reserve. One axe runs along the Western and Southern edge of the reserve radiating from the Southwest Corner where the Yangambi Research Station sits (N=243 households). The other axes run from the northeast along the northern edge of the reserve in particular the Yangambi-Weko axis to the west (243) and Bengamisa-Weko (170) to the north, both areas of deforestation and encroachment. The survey was carried out over ten days during December 2017. The three-stage sampling procedure included purposeful sampling (used to equitably select households along the two major axes) and random sampling based on population sizes (established by development plans) and on the population in the village.

To detect variability in household and farming characteristics across the area, the sample was divided into quartiles based on the estimated total value of activities for each household (US\$/day [median]) as shown to the right. The wealth-ranked quartiles (upper, upper middle, lower middle, lowest) can play an important role in benchmarking. Evidence shows that even wealthier households—which manage to derive slightly higher incomes from their activities—struggle to reach the standard poverty threshold of US\$ 1.9/person/day.

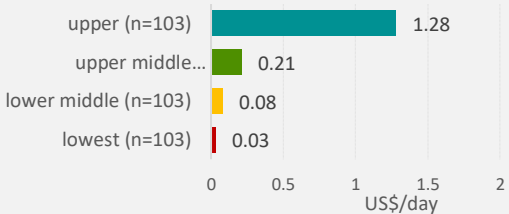


Figure 2 Total value of activities (median, US\$/day) by income quartile

Households demographic and decision making

Similar to national and regional trends¹, households in Yangambi are large, each consisting of five to seven persons. Household composition largely varies with income level. Higher income households are typically smaller in size compared to their less affluent neighbors; on average, households in the upper and lower wealth quartile are each formed of three to six and five to eight members, respectively². The large average household size and the fact that none of the households in the area is able to climb out of poverty (fig. 2) are a first indication of the spread and magnitude of economic vulnerability of the population in the area.

Households are led by relatively young persons.

Women heads of household tend to be younger and have a larger age distribution than men. Fifty percent of the women surveyed are aged between 21 and 50, while nearly 50% of the men heads are between the ages of 30 and 50. Women and men above 60 years of age represent less than 5% and 10% of all household heads, respectively (fig. 3). A young population is a key demographical characteristic of the DRC, where median age of the general population is 16.8, more than half of the household members are under the age of 15 and less than one sixth of the households are headed by older persons (60+) [3].

Women and men have almost equal power of decision-making over income and food stuff.

Men in wealthy households tend to have slightly greater influence over decisions compared to women (fig. 4), yet the gender disparity ratio is relatively low (40:60) if compared to the normative gender division of labor prevalent throughout the Congolese society [4]. The higher female control of the lower income quartile is likely due the presence of more female-only headed households, who tend to be poorer but have higher control on resource distribution. A balanced gender control of decision-making plays an important role in the distribution of and access to opportunities and assets, which are

essential prerequisite for enhancing farm productivity, food security and household wealth.

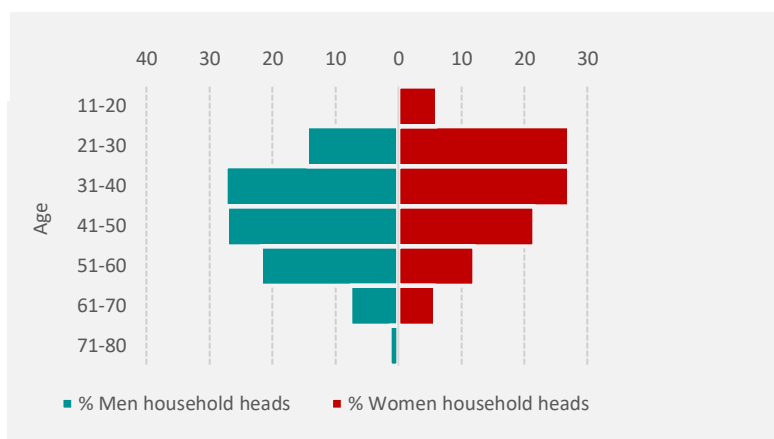


Figure 3 Age of household heads (% men, % women)

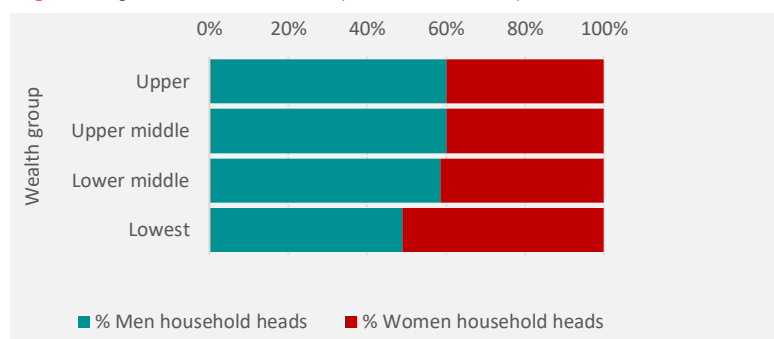


Figure 4 Control over decision making (% men, % women)

Household heads in Yangambi are generally more educated compared to their national counterparts. More than half (59%) of the household heads report attending secondary school while only a quarter (27%) attended primary school. Less than 10% of the population has not attended school at all. School attendance rates around Yangambi are significantly higher than national averages, which indicate that 37% of the household heads attended and completed secondary school [5]³. This may be an artifact of the Belgian-established research station and that many persons worked at the station at some time. School attendance rates do not vary across wealth quartiles, suggesting certain degree of equity when it comes to access to education. However, the paradoxical situation of widespread economic poverty and evidence of significant human capital, suggests that there are little opportunities for households around

¹ In DRC, average household size is 5.3 members, while averages across Africa range between 3-4 (south) and above 6 (west) [3].

² In some isolated cases, lower income households around Yangambi may consist of up to 12 members.

³ However, primary school attendance rates in Yangambi remain below national and provincial averages (roughly 85% and 70%, respectively). The province here refers to the Province Orientale, to which YBR belongs. Primary school attendance rates refer to percentages of all children aged 6-12 attending primary school.

YBR to capitalize on education, which is otherwise a critical household asset for farm and livelihoods development.

Farming systems

Households around Yangambi practice mixed, subsistence farming on small plots. One household typically cultivates between 2 and 4 ha of land, which is slightly above the average in DRC (between 1 and 1.5 ha⁴). In a few exceptional cases, households may work plots of 7 to 10 ha⁵. Small-scale farmers combine short-cycle species with perennial crops according to a rotation system called “Zongisa” in Lingala. This varies according to the type of land and the number and types of crop cycles. A typical rotation on dry land would include cassava, banana, maize, legumes, sweet potato in the first cycle, cassava, maize, legumes, and peanuts in the second cycle, followed by peanuts, soybean and cowpea in the third cycle. Due to a combination of factors—insecure land access, low productivity, low value addition and access to markets—households produce mostly for own consumption (as a means of subsistence) and less so for commercial purposes⁶ [7].

Land is managed through traditional shifting cultivation (slash-and-burn). Virtually all households around YBR (90%) clear land for farming and then leave it to rest for certain periods, in a cyclical way (fig. 5). For generations, much of the deforestation in DRC has happened in the “rural complex”, a landscape of forests, deforested land, agricultural fields, fallows, and logging fields [8]. When tree cutting extends beyond the boundaries of the complex into new forests and when fallows are short, such practices become highly risky to the ecosystem. In Yangambi, use of legumes to improve soil fertility is rare (practiced by only 4% of the households) and fallow periods are getting shorter⁷, limiting the recovery time of the natural vegetation. As a consequence, farmers increasingly witness soil fertility loss, weed invasion and low yields.

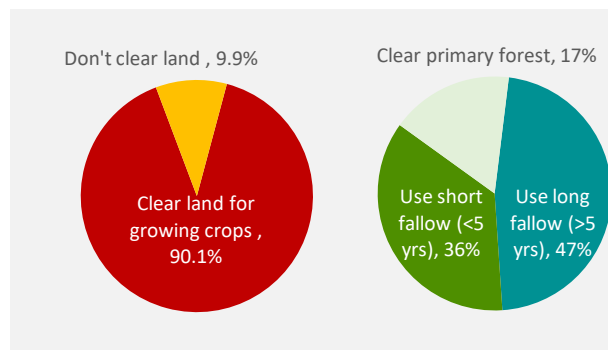


Figure 5 Land use around Yangambi. Traditional shifting cultivation—using both short and long fallows—is the typical way of farming in the area.

Starch and cereals are the main crops grown around Yangambi. Virtually everyone in the area (91% of the households) cultivate cassava, given its high cultural value and biophysical relevance. The crop is particularly common in forest areas due to its low requirements of nutrients and high tolerance to soil acidity. Farmers also grow maize (cultivated by 68% of the households), rice (67%)⁸, sweet banana (62%), tomato (61%), leafy grains (52%), chili pepper (48%), and amaranth (46%), among others. Fewer households grow vegetables (11%), cacao (6%) or beans (5%). Despite the collapse of the marketing system, oil palm continues to be harvested (by picking) and its products are processed locally by small artisanal units.

Typical livestock include chickens, goats and pigs. The number of animal heads per household varies significantly with livestock type and household, from one to nearly fifteen. In most cases, livestock is mainly a monetary reserve allowing farmers to face extraordinary expenses (sickness, burial, celebrations), but not a primary agricultural activity. As is the case in the entire Congo basin, meat production around YBR is limited, primarily due to the presence of the tsetse fly and limited availability of feed [9]. Hence, many households supplement their diets with bushmeat (see p. 7).

Agroforestry is common among a few farmers. Only about a third of farmers report growing trees on farms, mostly for food or fruit (49% of households),

⁴ However, there is significant variation in land area cultivated across regions, with higher area per household (between 10 and 13 ha) in Haut Katanga (near the border with Zambia) and lower averages (below 0.5 ha) in Nord Ubangi (north), Equateur (east), Kwango (southwest), Manlema and Lomani (centraleast) [6].

⁵ This area could represent several plots cultivated in any year or season.

⁶ Commercial plantations of cash crops were common during the colonial and post-colonial period but most of these are now either abandoned (e.g., coffee, rubber) or poorly maintained [6, 7].

⁷ In DRC, shorter fallow periods are associated with increased demand for food (as population increases) and restrictions related to field expansion into the forest.

⁸ Cassava, maize and rice also represent the main staple foods consumed nationally.

energy (18%), medicine (15%) and, to lesser extents, for timber (1%), land improvement (7%) and other purposes (10%). When a new field is opened, farmers choose to keep some useful tree stands, most often for attracting caterpillars. These tend to disappear after consecutive rotations on the same plot, mainly due to fires during the preparation of crop cycles. Just under half of the farmers surveyed protect trees that are useful for growing crops⁹, the density of protected trees being estimated at three trees per hectare. The most common are: *Petersianthus macrocarpus* (Osoo), *Ricinodendron heudelotii* (Lisongo), *Pycnanthus angolensis* (Likoka) - native caterpillar trees; *Persea americana* (avocado), *Schorodophloeus zenkeri* (Ofili), a native tree whose leaves are used as a condiment, the exotic fruit tree *Erythrophileum zenkeri* (Olanda), and *Dacryodes edulis* (Safoutier). The area presents large opportunity to promote locally-tailored agroforestry systems and address some of the most common and urgent uptake barriers, such as markets and commercialization, resource governance, and availability of and access to quality tree planting material, among others.

Farmers rarely use agricultural inputs, fertilizers and pesticides. Only about 5% of the households use improved seeds and 2% manure as fertilizer. While use of inorganic fertilizer more than doubled over the past years in the DRC—from 1.4 kg/ha in 2013 to 3 kg/ha in 2015—, no one around Yangambi reports using it. Likewise, medicine acquisition and use for livestock is not very common. Of the 10% of the people who report using veterinary medicine, nearly 60% used it with pigs, about 30% with chickens and 10% with goats. Low use of fertilizers, pesticides, veterinary products, and other agricultural input has been an important explanatory variable for the low productivity throughout the DRC; it has been associated with and an informal, dysfunctional inputs market (especially seeds) and farmers' limited access to information, technology, or cash, among others.

Local land ownership relies primarily on customary rights. Contrary to national trends, which indicate that 86% of the farm households

cultivate their own land [5], more than 60% of the households around Yangambi use family land and only 30% report using own land¹⁰. Renting land is uncommon but occurs, with about 10% of households reporting either renting or renting out land (usually without written documents). The incidence of written land titles, estimated at 11-20%, is rather exceptional in the entire Tshopo Province [6]. The lack of secure title is believed to inhibit farm investment, technology adoption, productivity and household prosperity [10]. However, there is no conclusive evidence that absence of land titles affects food security in the study area, as food shortages hit households indiscriminately (see p.8); yet it is likely that the vulnerability of the local community increases, as external stakeholders claim access to local land and resource.



Agricultural field near Yangambi. Photo: Axel Fassio/ CIFOR

Forest resources: access and use

The reserve is an important livelihood support source for its neighboring population. Almost 80% of the respondents visit it frequently: 14% of them every day, 35% almost every day and 32% once or twice a week. Only 5% claim to never enter the reserve. While the survey does not provide insights into impacts—as respondents were not asked about types and frequency of activities undertaken in the reserve, it does highlight the value of forests to the population living in the area. Such a

⁹ Trees are mostly intercropped with cassava (roughly 14% of the surveyed households), rice (8%), plantain (7%), spinach (6%), tomato (6%), maize (6%), chili pepper (5%), and amaranth (3%).

¹⁰ Traditionally, especially in forest area, the land belongs to the larger family and households access land that belongs to the family.

In the national survey, “family” land may have been considered as “own” land because it is not considered as “land belonging to somebody else” or “land that is rented for a definite period of time”.

situation is not unique to Yangambi, as forests occupy more than half of the country's total surface, providing food, shelter and income for 40 million people.

Forest resources are generally abundant and relatively easily accessible, except for food. Of all the key forest resources, food (bushmeat and other wild foods) is reported to be the least available and most difficult to access, yet still considered common by almost a third of the people. For the most part, food is inaccessible due to scarcity¹¹, confirming existing narratives of reductions in fauna in the reserve. Accessing energy, materials, medicines and water resources is becoming increasingly difficult for many respondents (fig. 6).

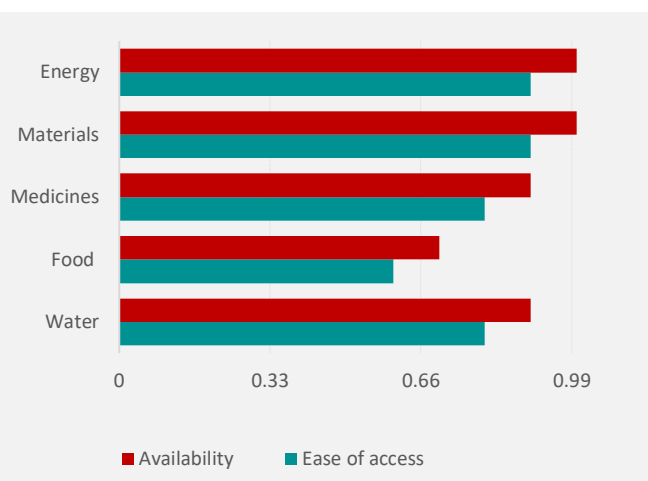


Figure 6 Availability of and access to forest resources. Availability was valued as abundant (1), common (0.66), rare (0.33), and extremely rare (0). Difficulty to access was valued as: very easy (1), relatively easy (0.66), relatively difficult (0.33) and very difficult (0).

Although scarce, bushmeat is hunted and collected frequently, primarily as a means of generating income. Roughly 84% of the households hunt and collect bushmeat¹² at some point during the year and roughly 34% do so any time of the year. Nearly half of respondents (44%) report selling more than half (60-90%) of the collected bushmeat, 17% sell between 40-60% of the meat, 25% sell less than half of the catch (between 10 and 40%) and 14% sell only a small part (less than 10%). While this clearly highlights the fundamental role of forests in people's lives, as

¹¹ Respondents also claim that food is harder to access due to the danger perceived in the area. No one quoted remoteness or concerns of bribery as reasons for difficult access; only few people referred to prohibition of resource use as access barriers, especially when it comes to water and medicine.

everyone derives some income from bushmeat sales, it also hints to a situation of continuous overexploitation of the resource which will likely augment in the future, as population is expected to increase.



Fish and bushmeat market in Yangambi. Photo: Axel Fassio (CIFOR)

Food insecurity and coping strategies

Although the area is rich in resources, people around the reserve experience food shortages. Food insecurity hits households indiscriminately, irrespective of their income status. This situation is not unique to YBR. Due to food shortages and limited market access, among other factors, food insecurity is endemic to rural DRC¹³. One in every two households in the country is classified as food insecure and one in every thirteen households is severely food insecure [5].

Food shortages occur mainly between January and March and are experienced by more than two-thirds of the households. The lean period normally lasts for three months. More well-off families may experience shorter food insecurity periods, yet these cases are isolated. For almost a quarter of the households (20-30%), the months of October through December may also be considered hungry months. Both the beginning and end of the year coincides with periods when roughly a third of the households (between 31-36%) collects

¹² Bushmeat collected includes: Rat de Gambie (Small rodent species that reaches 1-1.5 kg.), antelope, snakes, Pangolin, birds, and monkeys, among others.

¹³ Food insecurity is also present among urban households. This is primarily linked to high food prices, which are among the highest on the continent.

bushmeat or hunts animals, signaling key periods when food insecurity interventions are required to reduce pressure on forest and improve livelihoods.

The first quarter, which coincides with the period of highest food shortages reported, is the time when households react the most, using different coping strategies. Measures vary in degree of severity¹⁴ and include: limiting portion size, reducing the number of meals, eating less preferred food, borrow food or money or rely on external help, among the key ones. The most severe coping strategy, limiting adult intake, is almost always the least preferred action, being used by only half of the households during the main lean season (fig. 7).

Diets: intake and diversity

The potential for chronic and acute malnutrition is significantly high in the area. Based on production statistics and household size, 61% the households survey reported insufficient food availability to meet 2,000 calories per day, falling below the standard calorie line¹⁵. Chronic malnutrition is, in fact, a regional and national problem; child stunting rates (under five years of age) average 30% in the country and 41-50% in the Tshopo Province.

Data show the lean period of the year is during the dry season, January through March. However, during an average time of the year, December¹⁶, diets are generally diverse. Cereals and tubers, vegetables, fruits, meat and milk, and sweets are consumed more than half the days of the week. Sweets are consumed every day and cereals and tubers almost every day¹⁷. For two-thirds of the households (67%) the Food Consumption Score (FCS)¹⁸ is above the borderline/acceptable threshold used by the World Food Programme (WFP) in the DRC, indicating fair consumption frequency of key

food groups during a week. Only food groups that are typically rare in the area (milk and oils) are not widely consumed. For some 10% of the households, key food groups are consumed less frequently during a week (a poor FCS of 21.4), revealing a small, yet important section of the population in need of permanent food assistance.

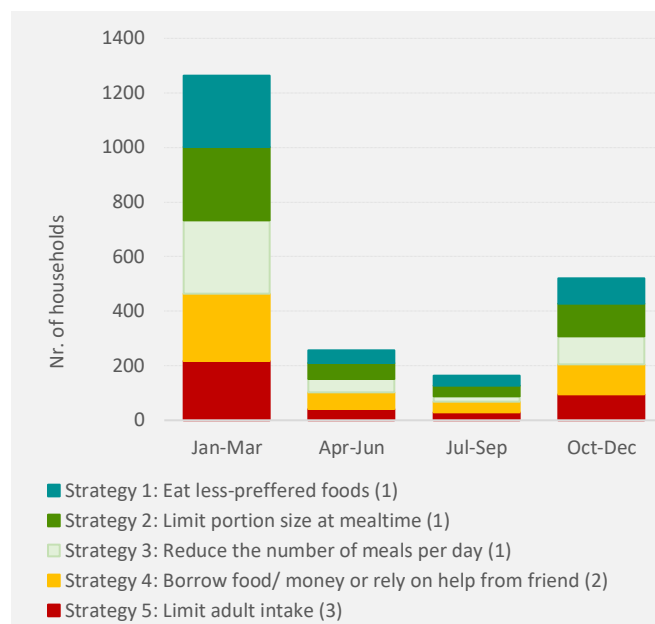


Figure 7 Households using coping strategies by year quarter. Degree of severity is expressed in parenthesis (3=most severe, 1=least severe).

Food crops are the foundation of most people's diets and also represent the most cultivated products in the area. Food crops represent between 70 and 80% of the calorie sources for households in the lower, lower middle and upper middle quartiles. For wealthy households (upper quartile), home-grown crops account for only 40% of the calorie sources, the remaining being supplied by livestock (about 40%) and by food acquired via off-farm income (roughly 20%). In general, low income households sell most of the meat to make additional income (fig. 8)¹⁹. The fact that a large majority of the population relies on food crops suggests a critical

¹⁴ Coping strategies are typically weighted according to the severity. The severities listed are the Universal Severity Weightings (also used by the EU).

¹⁵ Standard calorie line refers to kcal/male adult equivalent /day, which is estimated at 2,500. All food consumed and income was included in the calculation, assuming that all income is spent purchasing local staple crops.

¹⁶ The month of the survey, December, is considered neither the best or worst month for food insecurity of the year; 19 persons identified it as worst and 15 as the best month.

¹⁷ Based on dietary habits in December.

¹⁸ The FCS was developed by WFP and aggregates household-level data on the diversity and frequency of food groups consumed over

the previous seven days, which is then weighted according to the relative nutritional value of the consumed food groups. The maximum FCS has a value of 112 which would be achieved if a household ate each food group every day during the last seven days. In DRC, FCS thresholds that are typically used by WFP are 28 (poor/borderline) and 42 (borderline/acceptable).

¹⁹ The household food availability analysis considers both consumption of self-produced food and food sales. The later, expressed as potential food equivalent energy (kcal) per capita per day, is an indicator of potential supply and represents a substantial part of food availability (e.g., via purchases of staple crops).

need to improve yields as a measure to ensure food and nutrition security in the area.

For households around the reserve, bushmeat is a common strategy for supplementing the low quantity of protein supplied by domestic animals. Virtually all people interviewed (98%) report consuming bushmeat at some point in the year. Half of the respondents eat bushmeat one to three times a week and 25% consume it daily or more than three times per week. A small fraction reports bushmeat consumption once or three times per month. While such findings reveal that bushmeat plays an important role in most people's diets, it also warns about the implication that this may have on conservation and livelihoods, if this increasingly scarce resource will be harvested unsustainably.

Household wealth and wellbeing

Financial hardship is pervasive across the entire area. Roughly 99% of households in all quartiles live below the poverty line and 1% report receiving zero cash income²⁰. Poverty incidence is high throughout the entire country (more than 70%) and is estimated to rise steadily by 2030, as population is expected to increase.

Most households derive the bulk of their income from crops. A clear pattern of development is visible where those who are better off are more dependent on diversified activities including livestock and off-farm employment (fig. 9). Less than a half of the households derive some off-farm income from government, fishing, own business, labor on other farms, remittances, rental equipment, and other activities, earning some extra US\$ 200/year. While income diversification opportunities in Yangambi are mostly available to wealthy households, neighboring regions (e.g., South Kivu) experience a growing trend of people taking up non-farm activities (small shops, handicrafts) as a way to supplement cash and to access credit.

Food accounts for more than half of total household expenditures. In total, annual

expenditures reported near US\$ 565/household²¹, with more than 65% being spent on food and 22% on livelihoods (school, health, communication, transport) and household and production items, respectively. This spending pattern is similar to national averages (estimated at 67% of household income) and suggests limited household capacity to invest on the farm and high susceptibility to spikes in food prices, as these would reduce real income and increase the magnitude of household poverty and overall vulnerability.

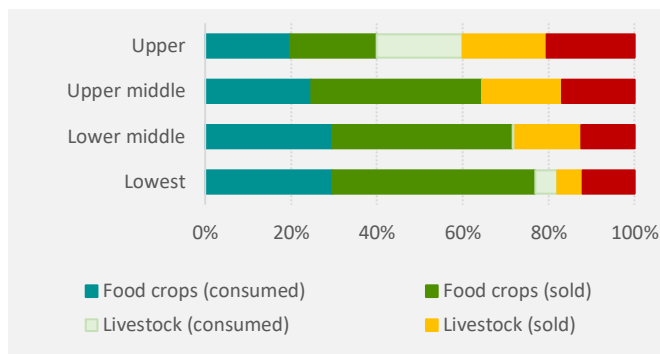


Figure 8 Calorie sources by wealth quartile. Diets in Yangambi rely heavily on food crops.

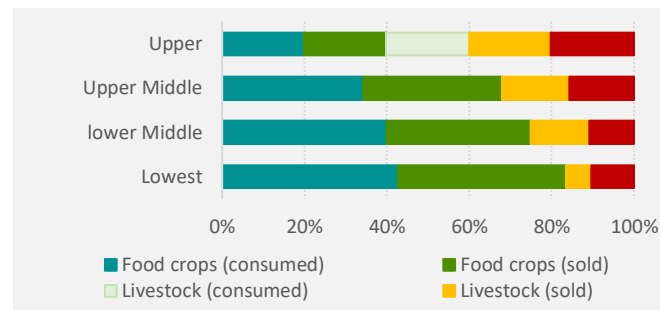


Figure 9 Share of activities in total income (%). For most households, most income is derived from food crops.

While houses are in good condition, ownership of physical assets remains a challenge for many.

The house condition is fair, with the majority of the households (59%) evaluated as being in medium condition and less than a quarter in poor condition²². Slightly more than a half of the households report having a radio or a bicycle (56 and 51%, respectively), but only a small part of the population owns phones or a TV (roughly 25% and 8%, respectively). Motorized transportation, which is important for enabling market access, is rare; while

²⁰ Based on calculation where only cash income is considered. RHoMIS also provides information on total economic value of all farm produce (both consumed and sold) and off farm work, using local prices. Poverty line refers to US\$ 1.9/day.

²¹ However, the variation in reported expenditure on these items was very large, ranging between 122 and 199%. In general, there is little evidence that recall on expenditure is accurate. In many cases we

found that recall on expenditure exceed income sources. Even so, the data provide a measure, though uncertain, of the types of relative amounts of expenditure.

²² During the interview, enumerators observed the materials that make up the house and rated the general condition of the house (subjective judgment), which indicate the material well-being of the household.

18% of the households own a motorbike none of them own a car. Agriculture implements such as tractors or rototillers are absent from all households surveyed, indicating that opportunities for livelihoods and farm development are very limited.



House near Yangambi. Photo: Axel Fassio/CIFOR. The majority of people lives in thatch roofed houses with earthen floors, the most readily available and cost-effective materials in the area. Metal roofs are usually indicators of increased socio-economic status.

The majority of households have access to safe drinking water and sanitation facilities. Eighty-one percent of the households source their water from boreholes, 8% from water tanks and only 2% use piped water; 9% use unsafe sources, such as surface water. Almost all households (93%) store water in lid/covered recipients. In 89% of the cases, human waste is usually disposed in toilet facility/latrine and hand washing is quite common before eating or preparing food and after toilet (90% and 63% of the cases, respectively). Overall, the situation in the area is significantly better than in many places in rural DRC, where safe drinking water is accessible to only a third of the households and only 4% use improved sanitation facilities. The source of drinking water is of particular importance to household wellbeing, as it is a main factor leading to fatal diseases; in DRC, one-third of the deaths relate to contaminated water. Sanitation (toilet facility, hand washing habits) is also critical to human health and wellbeing, providing insights into food hygiene conditions.

Households around YBR report varying financial situations. More than 75% of the respondents claim to be able to buy what they wanted but have trouble saving. Of these, over a half (55%) need to live

economically and roughly 2% would apply more drastic measures, such as buying the cheapest food, clothes and renting the cheapest house. No one reports not being able to buy even the cheapest food. Only about 15% of all households interviewed have the ability to save, suggesting very little capacity of the population to cope with market or climate shocks that may affect production or household income.

Opportunities for investment

The communities around Yangambi are isolated and poorly connected to markets. Most transportation happens on rivers and farmers have a hard time selling farm products or carrying out off-farm activities. Forests resources, which are critical for mitigating people's food and income vulnerability, are becoming increasingly scarce and threatened by expansion of the agricultural frontier even though slow. Yet the area also presents immense potential to reverse the trends and reconcile livelihoods and conservation goals. A few of these options are discussed below.

Agroecological intensification. Agriculture is the main household activity around Yangambi. Yet yields are very low, soil fertility is a major constraint and farming is therefore of little value to farmers. The improvement of the current agricultural system is essential, as agriculture accounts for up to 90% of the value of activities and poverty is common to all households. Agroecological intensification could have a quick effect on short-term agricultural yields and on farm resilience in the longer term. Such measure could involve: production and distribution of improved plant material, improved fallows (production of legumes), fire reduction and weed management, as well as pest and disease management.

Agroforestry. A diverse diet promotes cognitive development and economic productivity. Around Yangambi, a third of the population has poor or borderline food consumption. Intake of fruits and vegetables, nutrient-rich foods, only occurs twice a week on average, even during the relatively good times of the year. Agroforestry can help alleviate nutrient shortages during harvest and lean periods, contributing to a diverse diet. This can be promoted at home, through the intensification of existing home

gardens which can rapidly increase food and nutrition security and boost income, or in the fields, through training on assisted natural regeneration, participatory tree selection and planting, and community protection of river banks and rehabilitation of degraded areas, among others.

Development of value chains. Group discussions revealed that most farmers spontaneously planted cocoa in the region by sourcing from former plantations in response to market signals and rumors of market development in the east. Cocoa production may increase pressure on the reserve, yet it clearly presents market-based options for increasing revenues in the region. With adequate assistance, cocoa can be produced sustainably without clearing of new forest land and help reduce household poverty. Further efforts are needed to rehabilitate existing cocoa farms by grafting improved genetic material, to develop sustainable cocoa agroforestry and to strengthen the value chain by forging public-private partnerships, particularly in eastern Congo and in neighboring provinces such as Bas-Uélé. Fact is, one measure alone cannot create a pathway out of poverty for people living around forests; it is through a mixture of rural interventions that sustainable livelihoods and landscapes in the area can be achieved.

Citations

- [1]. Debroux, L. et al. 2007. Forests in Post Conflict DRC: Analysis of a Priority Agenda.
- [2]. Tyukavina et al. 2018. Congo Basin forest loss dominated by increasing smallholder clearing. *Science Advances* 4: eet2993.
- [3]. UNDESA. 2017. Household size and composition.
- [4]. Oxfam. 2018. Kasai: The Forgotten Province of DRC Gender Assessment.
- [5]. WFP. 2014. Democratic Republic of Congo. Comprehensive Food Security and Vulnerability Analysis.
- [6]. Marivoet, W et al. 2018. Understanding DRC's Agricultural Paradox: Based on the eAtlas Data Platform, Addis Ababa: ReSAKSS.
- [7]. FEWS NET. 2015. Democratic Republic of the Congo. Staple food market fundamentals.
- [8]. Molinario, G., et al. 2015. Forest cover dynamics of shifting cultivation in DRC: a remote sensing-based assessment for 2000–2010. *Environmental Research Letters*, 10(9), 094009.
- [9]. Megevand, C et al. Deforestation trends in the Congo Basin: reconciling economic growth and forest. IBRD, World Bank.
- [10]. AUC, ECA, AfDB. 2010. Land Policy in Africa: A Framework to Strengthen Land Rights, Enhance Productivity and Secure Livelihoods. Addis Ababa.

