Agrarian diagnosis of the Wonegizi and Wologizi Proposed Protected Areas (W&W PPAs), and the Bluyeama Community Forest

Summary

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Preamble

The overall objective of this agrarian diagnosis is to describe the livelihood activities of the local communities (farming first, but also NTFPs collection, logging, hunting, fishing, etc.); the associated social, economic and environmental challenges; the key actions to overcome these challenges, to be included in the AFD-funded project.

It should be stressed that the data presented in the following sections have to be treated with caution, as they are extrapolated from a limited number of observations and as some of these data are highly variable (i.e. depending on the seasons and/or the communities). However, these data have the merit of being first-hand and of providing concrete orders of magnitude, which are otherwise lacking in the grey literature produced by the projects that have followed one another in recent years in the region.

1. Context: small communities spread over a large forest area

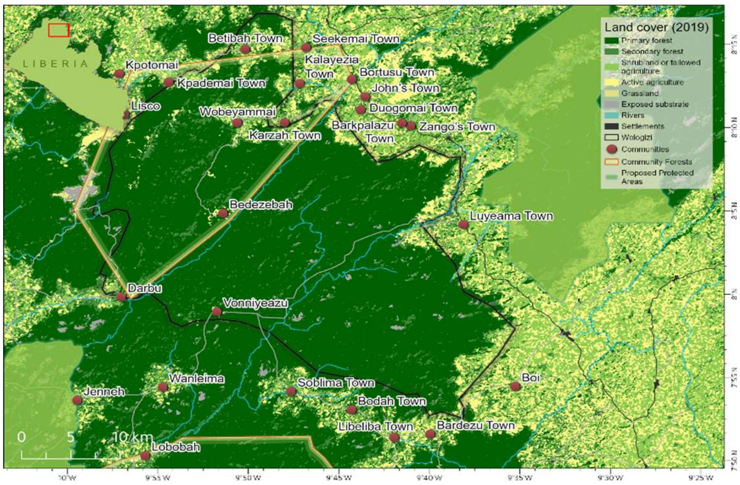
Population: The Wonegizi and Wologizi Proposed Protected Areas (W&W PPAs) and their immediate surroundings are populated by small communities, scattered over large areas:

- Wonegizi: 3,020 people in 2023 [according to a population census made in 2017 (F&F, 2024)[1] and extrapolated for 2023, considering an annual average growth rate of 1,99% between 2017 and 2023[2]], distributed over 16 communities (494 people/community in average, with range between 189 to 3,020 people/community), giving a low density of population (10,9 people/km² if the estimated population is related to the surface area of Wonegizi PPA);
- Wologizi: 26,880 people in 2023 (according to a population census made in 2024 (F&F, 2024)], distributed over 25 communities (1,075 people/community in average, with range between 32 to 3,750 people/community), giving a very low density of population (3,8 people/km² if the estimated population is related to the surface area of Wologizi PPA).

The Bluyeama Community Forest, South of Wologizi PPA, is made of 12 communities, out of which 7 are included in the 25 communities related to the Wologizi PPA. To our best knowledge, there is no census of the population of the remaining 5 communities.

Distribution: The communities are made of a mix of ethnic groups: Lorma, Kissi, Mano, etc. dominated by Lorma. It is quite usual to encounter in these communities a few migrants from Guinea, settled for long in most cases. Most of the communities are located near the Zorzor/Voinjama road, but some are in remote areas, including a few enclave settlements within the PPAs (e.g. Bedezebah in Wologizi).

Broadly speaking, the communities are enclaved (uneven terrain, poor road conditions) and it seems the few cash crops (e.g. groundnut, pepper, bitter ball, plantain, cocoa, etc.) are marketed more in neighbouring towns in Guinea (Gueckedou, Macenta) than in Monrovia or other Liberian towns. The ongoing reshaping of the Zorzor/Voinjama road (South-East to North-West)and the Voinjama/Foya road (East to West) may surely change the situation in the near future.



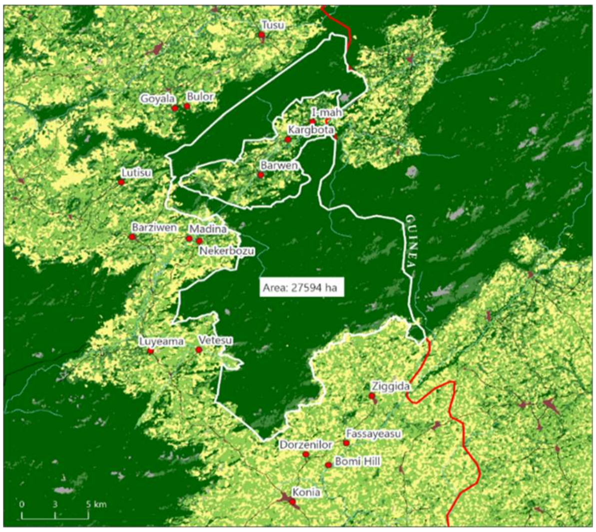


Figure 1 – Maps of Wonegizi (r.) and Wologizi (l.) PPAs (F&F, 2019)

Public services & basic infrastructures: Communities generally lack public services (e.g. agriculture extension, health services, primary education, etc.) and basic infrastructures (e.g. drinking water wells, clinics, primary schools, etc.). The population mainly obtains its water for drinking and other domestic use from undeveloped/unprotected sources (e.g. creeks). Some villages also have covered wells equipped with hand pumps, but their use is limited to certain periods of the year (in order to preserve the resource).

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[1] F&F, 2024. Estimated population in Wonegizi and Wologizi in 2017 and 2023. Excel file

[2] https://datacommons.org/place/country/LBR?category=Demographics&hl=fr#Taux-de-croissance-de-la-population

There are a number of local markets along the main road, Konia and John's Town being the main ones.

Local weather & soil conditions: They are characteristics of a tropical monsoon climate[3]: long rainy season (approx. March to October, around 250 rainy days per year) and high average annual precipitation (around 2,500 mm/year), but the rainfalls tend to be increasingly erratic in time and space (see part 7 infra). As is generally the case in Liberia, soils are relatively poor and not very fertile. The soils of the region are also characterised by their iron toxicity.

2. Livelihoods: diverse sources of food and income, dominated by farming activities

Overview: Households can be described as farmers and hunters-gatherers, trying to make the most of the surrounding natural resources, but farming remains the main activity and leads to a general degradation of forest and soils, caused by shifting cultivation practices (slash-and-burn). Livestock farming is a minor activity in the area (see part 6).

Households can be generally considered as vulnerable (to economic and/or climatic shocks), especially during the hunger gap (approx. August to October, before the rice harvesting). To face difficult times, households can rely on a limited number of coping strategies (e.g. sale of bushmeat or NTFPs, sale of seed in extreme situations, etc.) and collective strategies or social safety nets such as group farm work ("ku"), saving and credit groups ("clubs" or "susu"). There are no public safety nets and very few supports from NGOs/Projects (incl. F&F) in the recent years.

Crop farming: a few farmers' field schools to promote the mulching technique on upland plots

Rice farming: limited distribution of NERICA seeds (a few kg per community: L19 for lowland, 12/13/14 for upland)

Tree cropping: cocoa plants distributed to some selected farmers in 2023 (NB: limited volume: 200 plants/farmer; Mercedes variety, selected for growing in full sun; distribution carried out at the end of the rainy season, explaining a high rate of mortality)

Vegetable gardening: establishment of a few vegetable nurseries (tomato, okra, onion, etc.).

Figure 2 – Overview of F&F livelihood support activities in the 6 "PAPfor communities" in recent years (authors, 2024)

Figure 3 – Upland field school near Kortee village

Figure 4 – Vegetable nursery in Kortee village

Farming systems: Agriculture is considered the main economic activity by the local population. Rice cropping on slash-and-burn land is predominant, although there are also a few small plantations of tree crops and, close to the homes, a wide variety of plants and trees cultivated on a very small scale, generally for self-consumption but sometimes also to generate some additional income.

Apart from rice, which is the main staple food, the other main crops are palm oil, groundnut, pepper, bitter ball (small aubergine), eddoes (*Colocasia antiquorum,* a species closely related to taro), maize,

[3] https://www.weather-atlas.com/en/liberia/zorzor-climate

cassava, plantain and various types of beans (including cowpea). In all, 30 crops were identified in the communities visited (see figure infra. The list may not be exhaustive)

Crop	Household consumption	Sale	Crop	Household consumption	Sale
Rice	+++	+	Okra	+++	
Pepper	+	+++	Sesame	+	+++
Bitter ball	+	+++	Cocoa		+++
Groundnut	+	+++	Coffee		+++
Plantain	+	+++	Oil palm	++	++
Eddoes	++	++	Rubber		+++
Cassava	+++	+	Sugar cane	+	++
Yam	+++	+	Pineapple	+	+++
Sweet potato	++	++	Orange	+++	
Cowpea	++	++	Avocado	+++	
Bean	++	++	Banana	++	++
Broad bean	++	++	Kola	+++	
Corn	+++		Coconut	+++	
Pumpkin	+++		Pawpaw	+++	
Cucumber	+++	+	Plum	+++	

Figure 5 – Crops grown in the villages surrounding W&W PPAs and their main use (authors, 2024)

Depending on the topography and type of crop, there are three main cropping systems:

- Upland cropping on slash-and-burn, mainly rainfed rice, with various other crops (see part 3);
- Lowland or "swamp" rice cropping, on plots with little or no development (i.e. with very little water control), on soils that are more or less hydromorphic (see part 4);
- Small-scale plantations of perennial crops (see part 5), mainly oil palm (generally less than 1 ha), coffee (often old orchards that are partially rehabilitated and exploited), cocoa (mostly recent and not yet fully productive) and, more occasionally, rubber and sugar cane.

Food security: Household self-sufficiency in rice is generally low. Most households say that they can hardly meet their food needs all year round from their own production. During the food gap, the purchase of rice, in cash (no credit), helps to cover needs, mainly through the sale of other agricultural products. The following chart provides an overview of seasonal patterns for the main crops, rice availability and cash in- and out-flows.

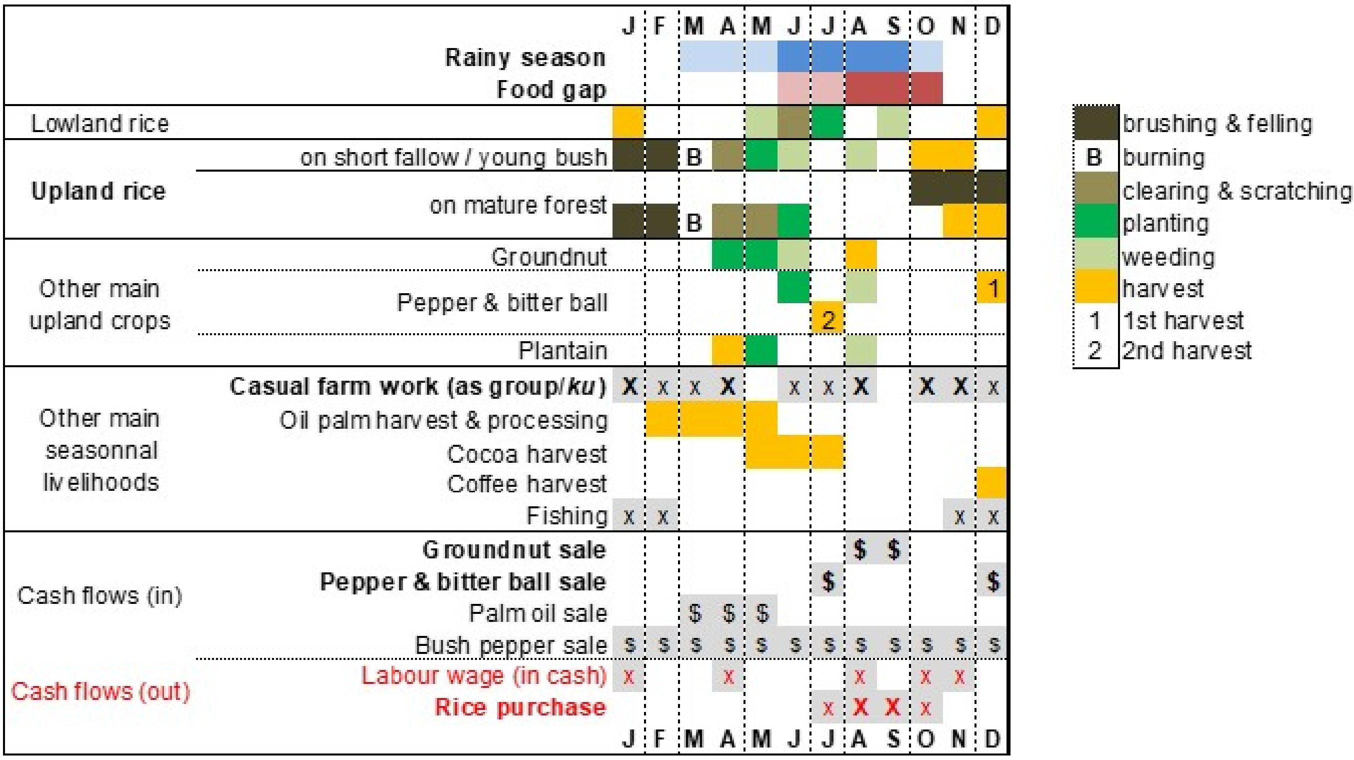

Figure 6 – Simplified agricultural and seasonal calendar for the study area (authors, 2024)

Sources of cash income: With the exception of NTFPs gathering (see part 5), hunting/fishing (see part 6), and small-scale / petty trade (village shops, collection-transport-sale of agricultural produce, etc.), the level of economic diversification into income-generating off-farm activities remains low.

Processing activities are essentially limited to rice hulling (contract service for the few households that own a hulling machine), palm oil extraction and distillation (palm wine). Temporary migration of labour to the towns exists but remains limited. Iron ore is present in the North of Wologizi PPA, as well as gold in different rivers of the W&W PPAs, but mining is estimated to be very limited.

The main sources of cash income are therefore agricultural. These include primarily groundnut, pepper and bitter ball (African garden egg), which most households produce and sell. Some producers manage to generate a surplus of rice, which they sell locally. Secondary products marketed include plantain, eddoes, bananas, beans, sesame, pineapple, coffee and cocoa. Palm oil, generally produced from fruit collected in the forest or from palm trees on cultivated plots, is another source of income.

These different products are either sold directly by the producers on local markets, or to intermediaries who pass through the villages. Goods are mainly transported by motorbike, as well as by car on the main road (transport of bags of peppers and bitter balls to Guinea or Monrovia, for example). There is no collective organisation among farmers for processing or marketing agricultural products (with the exception of a few grouped transports to reduce costs).

Farm income is supplemented by the sale of labour, which concerns both men and women, and generally takes the form of contracted work groups ("ku") for a specific agricultural work, e.g. felling and clearing plots (men), cleaning and hoeing/scratching (women), harvesting rice (women), etc. Payment may be by the job (for a given area) or by the day. There is a pay gap between men and women (around 300-350 LR$/day for men compared with 200-250 LR$/day for women).

Land tenure: Access to land and natural resources is governed by customary rights, but this is regulated flexibly, with relatively few constraints on farmers. Broadly speaking, agricultural and forestry land is divided between the different villages, and then within each village between the different clans, each with a fairly well-defined territory.

The native families of the area are historically the holders of land tenure, although there are no deeds or formal documents. They are represented by landlords, who can, if necessary, regulate access to the land, for example whether or not it is possible to clear new land or establish perennial plantations (cocoa, coffee, etc. NB: planting tree crops is considered as a permanent proof of ownership).

At the start of the season, the various households indicate the plot of land they plan to clear and cultivate by placing distinctive signs on the trees (see photo opposite).

Once a new plot of primary forest has been cleared, the "axe right" applies, allowing subsequent use rights on plots left fallow, including for descendants of the clan.

Figure 7 – Photo of marking used by farmers in preparation for land clearing

Generally speaking, there are no problems of access to land in the communities of the region of interest, nor land pressure (no sale, no rent of land). Although it is true that a farmer can only farm on land belonging to his clan, there is sufficient space available for everyone. Households not originally from the area (such as Guinean immigrants, for example) can easily gain access to a plot of land, free of charge, after identifying and requesting the landlord (also called "stranger father").

Men and women from the same household generally share the same field. Women usually work most of their time on the family plots, which will produce food crops or cash crops for the "common pot".

However, they are also given access to some parts of the family plots to grow groundnut (after a 1st and sometimes 2nd year of rice) and authorised to keep the cash from its sale for their own use.

Workforce: Agricultural labour on the slash-and-burn plots is primarily family-based. However, the majority of households use mutual aid and labour exchange mechanisms between farmers (the “ku” system), as well as purchasing labour. The number of workers in the household and its financial resources largely determine the use of external labour, whether in the form of payment or mutual aid. In the case of ku, the exchange of reciprocal labour obliges the recipient, and the cost of meals (paid for by the recipient farmer) is not negligible.

The level of education and agricultural training of male and female farmers is generally low, with an undoubtedly high illiteracy rate and virtually no access to training and technical advice (i.e. agriculture extension officers are very few and not present in the communities, having no motorbikes; NGOs/projects are very few).

Other assets and production factors: Farm equipment is exclusively manual (axes, cutlasses, hoes, shovels, etc.). There is no bullock traction nor motorised equipment (e.g. power tillers, tricycles, motor pumps, etc.) with the exception of a few rice hullers (bearing in mind that many households keep their rice in the husk, threshing and pounding it as and when they need it). The use of chainsaws to fell trees on slash-and-burn farms and possibly to make planks has become widespread in recent years.

Household access to credit is limited overall, and virtually non-existent in the case of farm credit. Crop advance systems are limited to a few very specific products (including certain NTFPs).

Apart from agricultural self-help groups (exchange of labour between producers) and village savings and credit groups (more or less formal depending on the support previously received from projects), there are very few farmer organisations.

Wood harvest: The major part of the harvest is for fuelwood, used as it is, generally on a 3-stone stove (no improved cookstoves). Charcoal production is limited, as urban centres are remote/scarce, and charcoal production is not very attractive (a 50-kg bag is sold at 2,4 US$ on the roadside).

Artisanal logging (“pitsaw logging”) is widespread over the area, but volumes are limited. Chainsawing is usually done directly in the forest, generally to produce 40-feet planks (different sizes: 1x10, 1x12, 2x8, etc. The “standard” one is 2x12). The planks are transported to the road on men’s backs, two at a time. This transport is tedious, which limits artisanal logging.

A few species of “red wood” are renowned and are sold at different prices: 4,2 US$/plank (standard one) for Iroko / *Milicia excelsa*, 4,2 US$/plank for Framire / *Terminalia ivorensis*, etc. There are 2 options to pay the chainsaw logger: (i) direct payment: 37 US$/tree to be felt + costs of gasoline, and the farmer keep all the planks, (ii) indirect payment: the chainsaw logger keeps 80% to 85% of the planks (NB: from 20-30 planks/tree, up to 100 for big trees).

Commercial logging is inexistent in the area. Community forest was practiced in Bluyeama. The Indian-based company “Singh Africa Plantations Ltd” have been operating from 2017 to 2022, employing 370 local staff and 37 expatriates, and exporting tenth of thousands of cubic meters of wood annually (10 species logged over the 49,444 ha of the Blueyama community forest).

The company left suddenly the premises in September 2022, leaving everything in the factory in tatters: sawmill benches, logs, sawn timber, etc. and also a large debt to the Bluyeama Community Forest association: 178,000 US$ of arrears (land rental fees, km fees, scholarship) and unbuilt infrastructure (2 schools, 2 clinics, 4 bridges).

A complaint has been lodged by the Association and the factory has been seized by the government pending investigation. The logs (stored outside) and equipment are beginning to deteriorate. The Chairman of the Association told us he would like the community forest to be converted into a conservation area.

Figure 8 – Chainsaw logging of planks after slash-and-burn

Figure 9 – Sawn timber seized at the Sing Africa Plantation factory

The FDA staff in the area is mostly dedicated to conservation. There is no staff in charge of commercial logging, as there is no private logging concession in the area. There are 3 staff in charge of the Bluyeama community forest. There are 20 conservation officers, 14 for the Wonegizi PPA and 6 for the Wologizi PPA (+ 5 local "auxiliaries" from the communities, in the case of Wonegizi). A conservation officer is paid 150 US$/month, is equipped with a motorbike (500 to 600 US$ for a brand new one), and receives 5 gallons of fuel per month (equiv. 25 US$/month). It is worth to note that the conservation officers supported by the FFI/NORAD project did not keep track of the infractions, as they were recorded by FFI.

3. Upland farming: rice first… and a lot of deforestation

Plot location/selection and fallow duration: Rice is grown on slash-and-burn land, either in primary forest (new clearings) or on fallow land. The length of forest fallow between two slash-and-burn crops varies from one community to another, depending on its location. In the main agricultural corridor, along the main road Zorzor/Voinjama, fallow periods are generally shorter, ranging from 3 to 7 years. In more remote areas, it is common to return to the same plot after at least 7 years of fallow.

Within the same community, the duration of fallow varies according to the space available within the clan and also the capacity (physical and/or financial) of the household to clear a new portion of land in primary forest.

The choice of whether to clear a new plot of forest or cultivate short fallow land also depends on the distance to be covered, the level of soil fertility (better in the forest) and competition from weeds (stronger on short fallow land). Plots are generally located within an hour's walk of the community, but this can be as much as 3 or 4 hours for new clearings.

Figure 10 – Slash-and-burn of an upland plot

Cultivated area: The annual area cultivated under slash-and-burn on the uplands is estimated at between 0.4 and 4 ha per household, with a median value close to 1.3 ha, according to the interviews, supplemented by observations of Google Earth satellite images of the slash-and-burn (these figures should nevertheless be treated with caution, as the local farmers know the quantities of seed used, but not the areas). With an average of 2-3 workers per household, the area cultivated per worker would be 0.5 ha on average.

The area cultivated on slash-and-burn depends essentially on the size of the household and the labour available, including the use of outside labour. In this type of cropping system, the main factors limiting the area cultivated are the workload for felling and clearing for plots in primary forest, and the workload associated with weeding for those in degraded forest or after short fallow periods.

Cropping practices: Under current practices, most trees are felled or burnt, with the exception of certain useful species (primarily oil palm, but also a few redwood trees that would be latter cut down for timber) and trees that are too large (which cannot be felled, e.g. cotton tree / *Ceiba pentandra* which has large buttress roots). Oil palm, although wild and/or naturally regenerated, is clearly integrated into shifting cultivation systems.

Figure 11 – Preserved palm oil trees after slash-and-burn

Figure 12 – Young rice shoots on slash-and-burn

Most of the paddy seed is self-produced (saved from the previous harvest). Seeds are broadcasted. The quantities used generally vary between 35 and 120 kg of paddy/household/year, with an average of around 60 kg.

Rice is combined with a large number of other crops, either planted before the rice and during land preparation (plantain, banana, cassava, palm, etc.) or at the same time (pepper, bitter ball, eddoes, maize, beans, cucumber, pumpkin, okra, sweet potato, yam, various leafy vegetables, etc.).

On young fallow land (less than 6 years old), there is a single cycle of rice, followed the next year by another crop, by dividing the plot into several portions (mainly groundnuts, but also beans, eddoes, manioc, corn, pigeon peas or sweet potatoes). After a new clearing in primary forest, farmers generally cultivate the same plot three years in a row (two cycles of rice followed by a crop of groundnuts, beans or other crops mentioned above). As a general rule, each household clears and cultivates a single main field each year, to which is added a "year 2" plot (which requires cleaning/weeding of the plot).

Farmers do not use any fertiliser. Mineral inputs are partly provided by ash from burnt areas. The system is based on the presence of trees in the forest re-growth, which allow mineral elements located deep down to be "brought up" (thanks to their root system) and "returned" through the fall of leaves and the accumulation of litter (organic matter).

The rice plots are weeded manually or with a hoe, once or twice depending on the length of the previous fallow period. After various cycles of slash-and-burn/cropping/fallow, some plots become difficult to cultivate: low soil fertility and strong competition with invasive weeds, e. g. *Imperata cylindrica*, Laos herb / *Chromolaena odorata*, etc.

We encountered only one farmer saying that he started using weedicides (glyphosate) on his upland rice, while a certain number of farmers said they use it more frequently to clean their plot before sowing their lowland rice (see part 4). Given that this type of weedicide is 50% subsidised in nearby Guinea, there is every reason to fear that its use will rapidly spread to upland areas, causing damage to the environment (water and soil pollution) and to health (products classified as carcinogenic since 2015 by the WHO. NB: There is very little if no knowledge at all of the harmful effects of weedicides on health and environment, even among local NGO staff).

Generally speaking, however, neither weed growth nor soil degradation are seen as major constraints by the farmers, as they can easily shift their plots. They are more likely to cite the poor condition of their farming tools, a lack of financial resources (to buy seeds, cultivate larger areas or invest in other activities such as small-scale livestock farming) or attacks by pests (birds, grasscutters, bush hogs, elephants, etc.).

Although groundnuts and, to a lesser extent, beans are widely grown, local farmers seem to know little about the usefulness of leguminous crops in terms of soil fertilisation (nitrogen fixation).

Yields: Yields per unit area are very difficult to estimate for several reasons: the areas cultivated are often unknown or approximate; several crops are combined on the same plot; harvesting is done as and when the household needs it; units of measurement vary (bundles of ears, bags, tins, etc.). Yields are much higher on new clearings or long forest recruits than on young bush, around twice as high.

Based on interviews and data supplied by F&F, rice yields on upland are estimated at around 0.9 t/ha of paddy in a normal year on fallow land of less than 7 years. Yields can reach an average of 2.1 t/ha in mature forests. Even if the quantities produced annually seem low (less than 2 t/household of paddy on average), it is important to take into account the many associated crops (pepper, bitter ball, eddoes, cassava, plantain, etc.), some of which (cassava, oil palm, etc.) can be harvested on fallow plots beyond the annual rice cycle. Some households also supplement their upland rice production with lowland/swamp rice.

Gender roles: Women participate in the family farming and thus contribute to the common pots (generation of food or cash for the whole household). However, they also commonly crop a part of the "family plot" in year 2, sowing groundnut. The quantity of seeds, and therefore the surface of groundnut, depends on their capacity to set the seeds aside for 1 year and to support the workload (either mobilising their own workforce and the ones of their children, and/or paying contracts or ku and collective meals). In some cases, it can be important: up to 10 tins of seed, allowing the sowing of 2 ha.

Women use the revenue of the groundnut sale to cover household needs (e.g. rice, condiments, soap, clothes, school fees) and also sometimes for their own needs (e.g. clothes). It is worth noting that women in the area do not seem to have separate gardening plots to grow vegetables, as it can be commonly seen in the neighbouring Guinea.

4. Lowland farming: a cropping system also based on rice… but few developed lands

Land type and location: Lowlands (also commonly called "swamps" by farmers, as most of them are made of hydromorphic soils and permanently flooded) are scarcely distributed over the W&W PPAs and the Bluyeama Community Forest, and generally of small size (a few acres, rarely up to a few ha).

They are quite heterogeneous, in terms of vegetation and water regime: most of them are hydromorphic ones (permanently flooded), covered with grass and shrubs, sometimes mixed with roast palm / *Borassus aethiopum*; the others (temporarily flooded) are covered with shrubs and trees, sometimes tall ones (e.g. cotton tree / *Ceiba Pentandra*).

Very few of them seem to be developed: during our field visits, we encountered 3 of them, 2 with drains and canals (both non-concreted), and a grid of dykes (compacted soil), most probably built by an ACDI-VOCA project that ended 5 years ago; 1 with a grid of dykes (again, compacted soil), most probably set up by farmers themselves.

In the absence of data (location, size, type of vegetation and water regime), we took various GPS points of these lowlands during the field visits, in order to latter try to identify them on Google Earth and produce estimates for the region of interest. Unfortunately, their smallness and the difficulty to differentiate them from degraded forests / fallows made the exercise impossible.

In the absence of surface estimate based on direct land use analysis, we turned the problem round, asking farmers in various communities what is the share of upland vs lowland cropping in terms of paddy production. Broadly speaking, considering (i) the volume of seeds used in upland (a few tins) vs in lowland (a few kg, i.e. $1/12^{th}$ less, as a tin of paddy is 12 kg), and (ii) the fact that the yields are comparable between lowland and upland / slash-and-burn of natural forest, but 2 times more than on upland / slash-and-burn of fallow, we can roughly estimate the ratio at 80:20. It does not mean that this ratio is frozen, as many lowlands are probably not cropped.

Figure 13 – Developed lowland (drain and grid of dykes)

Figure 14 – Unlevelled lowland on a river bank

Access of farmers to lowland: Between 1/2 and 2/3 of the farmers in each community declare having access to at least one lowland. As any other type of land in the area, customary rights are permissive and access to these lowlands is free. Cultivated swamps or lowlands are generally located next to the upland fields on the adjacent slope, within the same plot managed by the same household, but with different technical itineraries.

The only (and major) difference with upland plots is that permanent rice cropping is possible in these lowlands (permanent nutrients supply with water runoff, high level of organic matter), which explains that after its first cleaning and cropping, a lowland is likely to be considered as the “property” of the farmer who developed it.

Technical itinerary and yields: In the table hereafter are the similarities and differences between upland and lowland rice cropping. With all due caution when analysing the technical and economic results, given the variability and imprecision of the field data collected, there are a number of interesting points to note:

- The production costs per acre are more than double in upland rice on forest (588 US$/acre) compared to upland rice on fallow (219 US$/acre) or lowland rice (267 to 335 US$/acre depending if the rice is simply broadcasted or need to be transplanted – if flooded condition);
- ...But the yield is more than double in upland rice on forest (2.1 t/ha) or lowland (1.8 t/ha) compared to upland rice on fallow (0.9 t/ha);
- …and upland cropping has the major advantage to allow producing associated crops (e.g. pepper, bitter ball, corn, etc.), production that could not be estimated or valued in the following table (as said supra: several crops are combined on the same plot; harvesting is done as and when the household needs it; units of measurement vary - bundles of ears, bags, tins, etc.). The value of these associated crops is significant, however.

Conclusion: all in all, if a farmer has the capacity to mobilise enough internal workforce (household) and/or to afford external workforce (contract and/or ku), he will tend to favour the upland rice cropping on forest. As there are no physical obstacles (accessible land, now and in the years to come, given the very low population densities) or technical-economic obstacles (good profitability) to growing upland rice on forest, apart from the ability to bear the production costs of this system, there is no reason why this practice should diminish in the future.

<table>
<tr><th colspan="2">Practices</th><th>Upland rice (on forest)</th><th>Upland rice (on fallow)</th><th>Lowland rice</th></tr>
<tr><td colspan="2">Rotation / intercropping</td><td colspan="2">Y1: rice mixed cropping (bitter ball, pepper, eddo, corn, etc.) / Y2: groundnut, beans or other crops in part of the plot / rarely a 2nd year of rice (only if slash-and-burn of dense forest) / Y3/4 to Y9/10: approximately 7 years of fallow</td><td>Rice, without association in general (hydromorphic conditions, only suitable for rice and a few other crops like sweet potatoes or maize if grown on moods)</td></tr>
<tr><td colspan="2">Cycle</td><td colspan="2">Brushing in December; Felling in February; Burning and brushing in March; Broadcasting in May-June and harvesting in September-October-November. 4 to 5 months cycle (local seeds, designated by their colour – red or white – and thus apparently little selected)</td><td>Broadcasting (if low water level) or transplanting (rare / if significant water level) in July-August and harvesting in December-January</td></tr>
<tr><td rowspan="7">Itinerary (for 1 acre)</td><td>Brushing of shrubs</td><td>1 day x 10 people x 300 LR$ for contract + 6,000 LR$ of collective meal = 9,000 LR$</td><td rowspan="2">1 day x 5 people x 300 LR$ for contract + 6,000 LR$ of collective meal = 7,500 LR$</td><td rowspan="3">Use of weedicides (Roundup) still rare, but more and more frequent (50% subsidies for these products in the neighbouring Guinea)
Steps carried out altogether (as lowlands are generally free of big trees and covered with grasses / shrubs): 2 days x 10 people x 300 LR$ + 2 days x 6,000 LR$ of collective meal = 18,000 LR$</td></tr>
<tr><td>Felling of trees</td><td>By hand (cutlass and axe): 3 days x 10 people x 300 LR$ for contracts + 3 days x 6,000 LR$ of collective meal = 27,000 LR$
By chainsaw: 3 days x 10 people x 300 LR$ + 4 gallons of fuel x 1,000 LR$/gallon + 7,000 LR$ of mixing oil + 500 LR$ of chain oil = 20,500 LR$</td></tr>
<tr><td>Burning and clearing</td><td>3 days x 10 people x 300 LR$ for contracts + 3 days x 6,000 LR$ of collective meal = 27,000 LR</td><td>1 day x 10 people x 300 LR$ + 6,000 LR$ of collective meal = 9,000 LR$</td></tr>
<tr><td>Upland: scratching and broadcasting
Lowland: scratching and broadcasting or transplanting</td><td>Scratching: 1 day x 10 people x 300 LR$ + 6,000 LR$ of collective meal = 9,000 LR$
Broadcasting: 3,000 LR$/tin x 1 tin = 3,000 LR$</td><td>Same</td><td>Scratching: 1 day x 10 people x 300 LR$ + 6,000 LR$ of collective meal = 9,000 LR$
Broadcasting: 3,000 LR$/tin x 1 tin = 3,000 LR$
OR transplanting: 2 days x 10 people x 300 LR$ + 2 days x 6,000 LR$ of collective meal = 18,000 LR$</td></tr>
<tr><td>Weeding</td><td>No need in most cases (few weed seeds in the forest soils)</td><td>2 days x 10 people x 300 LR$ + 2 days x 6,000 LR$ of collective meal = 18,000 LR$</td><td>2 days x 5 people x 300 LR$ + 2 days x 3,000 LR$ of meal = 9,000 LR$ (less weeds in wet condition)</td></tr>
<tr><td>Scaring birds</td><td colspan="3">14 days x 1 person x 300 LR$ = 4,200 LR$</td></tr>
<tr><td>Harvesting</td><td>2 days x 20 people x 300 LR$ + 2 days x 6,000 LR$ of collective meal = 24,000 LR$</td><td>1 day x 20 people x 300 LR$ + 6,000 LR$ of collective meal = 12,000 LR$</td><td>2 days x 20 people x 300 LR$ + 2 days x 6,000 LR$ of collective meal = 24,000 LR$</td></tr>
<tr><td colspan="2">Total of production costs</td><td>123,700 LR$/acre, i.e. 651 US$/acre</td><td>62,700 LR$/acre, i.e. 330 US$/acre</td><td>67,200 – 82,200 LR$/acre, i.e. 354 - 433 US$/acre</td></tr>
<tr><td colspan="2">Yield (caution: rough estimate!)</td><td>Approx. 70 tins/acre, i.e. 2.1 t/ha</td><td>Approx. 30 tins/acre, i.e. 0.9 t/ha</td><td>Approx. 60 tins/acre, i.e. 1.8 t/ha</td></tr>
<tr><td colspan="2">Production cost per kg of paddy</td><td>0.31 US$ per kg of paddy</td><td>0.37 US$ per kg of paddy</td><td>0.20 – 0,24 US$ per kg of paddy… But few if no associated crops (pepper, bitter ball, corn, etc.)</td></tr>
</table>

Figure 15 – Comparison of itinerary / yield / production cost for upland vs lowland rice cropping (authors, 2024)

5. Tree crops and NTFPs' collection: an overview of the many value chains

Tree crops (mostly local wild oil palm, cocoa, coffee) are most of the time little managed, reason why their operations are more akin to picking wild NTFPs and are therefore presented together with NTFPs in the table below (NB: LR$ converted to US$ ➔ 190 LR$ = 1 US$).

Name	Presence[1]	Men and/or Women / Sources	Use[2]	Processing	Harvest period												Farmgate price / Trend
					J	F	M	A	M	J	J	A	S	O	N	D	
Cocoa *Theobroma cacao*	+	M & W. Small plantations (approx. 100th of trees)	Trade: +	Minimum (fermentation of the beans)					■	■	■						1.5 US$ per kg (LR) ↑ 3-3.5 US$ per kg (GN)
Coffee *Coffea canephora*	++	M & W. Small plantations (approx. 100th of trees)	Trade: +	Nil (cherry) to minimum (beans fermentation)												■	1.9 US$ per kg ↓
Wild oil palm *Elaeis guineensis*	++++	M & W. Wild harvest in forest + trees in fallow land + small plantations (approx. 100th of trees)	Trade: ++ HH: ++	Red oil: fruit processing + kernel processing (soap)			■	■	■	■							11-16 US$ per 20L →
				Wine: sap fermentation	■	■	■	■	■	■	■	■	■	■	■	■	?
Roast palm *Borassus aethiopum*	+++	M. Wild harvest in lowland	Trade: + HH: +	Wine: sap fermentation			■	■	■	■							?
Bitter kola *Garcinia kola*	+++	M. Wild harvest in forest (isolated trees)	Trade: +	Nil										■	■	■	3.7 US$ per kg →
Bush pepper "Vevegui" *Aframomum melegueta*	++	M & W. Wild harvest in forest (isolated herbs)	Trade: ++	Nil										■	■		2.6 US$ per kg →
Bush pepper "Silvergui" *Xilopia aethiopica*	++	M & W. Wild harvest in forest (isolated lians)	Trade: ++	Nil										■	■		26 US$ per kg ↑
Snails *Lissachatina fulic*	+++	W. Wild harvest in forest	Trade: + HH: ++	Nil				■	■	■	■	■	■				5.3 US$ per kg
Mushrooms Many types	+++	W. Wild harvest in forest	HH: +	Nil				■	■	■							Not traded
Wild honey	++	M. Wild harvest in forest	Trade: +	Extraction and coarse filtering		■	■	■									6.6 US$ per liter →

[1] + = Rare ++ = Infrequent +++ = Frequent ++++ = Widely spread [2] HH = Household consumption

Figure 16 – Key characteristics of the main tree crops and NTFPs harvested in the W&W PPAs (authors, 2024)

6. Hunting, animal husbandry and fishing: complementary livelihoods and sources of protein

Hunting practices and hunted animals are described in more details in the biodiversity assessment of the feasibility report. We can remind that the "grasscutter" (*Thryonomys swinderianus*), the "porcupine" (*Hystrix cristata*) and the "bush hog" (various species here: *Phacochoerus africanus, Hylochoerus meinertzhageni, Potamochoerus porcus*) are the most commonly hunted animals, as they attack a large variety of crops (rice, legumes, even groundnut). It is worth noting that the grasscutter, which lives near wetlands, is feared by lowland rice growers.

The bushmeat is usually consumed at the household level and rarely sold, except perhaps during the hunger gap. Prices recorded during field interviews appear moderate, if we reduce them to the weight of the animals: 8.4 US$ for a porcupine sold as a whole or 15.8 US$ for a bush hog sold as a whole.

Animal husbandry is generally rare: a few local chickens (raised for the flesh, little or no consumption of eggs. NB: 3 US$/chicken) and ducks (same. NB: 5 US$/duck), a few pigs for a minority of households (rarely more than 5-6 pigs including breeders), a few small ruminants (with small herds of goats and sheep mainly concentrated in the few Mandingo settlements) and virtually no cows (at the exception of a few Fulani herders occasionally crossing the landscape with their cattle), very few beehives.

With the exception of pigs, which are reared in small wooden shelters and fed on various crop products or by-products (rice bran, maize, palm cake), most animals are left to roam and receive no specific feed.

Even though it is rare, livestock farming is demanded and seen as a means of saving to meet urgent cash needs (school fees, health care, etc.). NB: a goat is sold at 70 US$, a sheep at 100 US$.

This general lack of animal rearing could seem strange, as there are no major "environmental" constraints identified: very low population density and no land pressure at present, no widespread disease such as the Newcastle disease (chicken) or the swine fever (pigs); trypanosomiasis is there, but local species are trypano-resistant (N'dama cows; Djalonke sheep; Dwarf Djalonke goat).

The reasons for this scarcity could be diverse and cumulative: readily available bushmeat, cultural habits (households not used to rearing animals that are kept by shepherds or tied to stakes, and also not used to protect their plots with wooden fences), taboos (e.g. goat meat consumption is taboo in some communities of the Bluyeama community forest area), difficulties in building up household assets and capital from existing cropping systems, etc.

Some informants noted that these reasons could have been aggravated after the publication of the Public Health Law - Title 33[4] which states that "*The following are hereby declared to be nuisances to be dealt with […] h) Any building or premises used for keeping of animals or birds which is so constructed, situated, used or kept as to be offensive or which is prejudicial, injurious or dangerous to health*". The literal (and probably excessive) interpretation of this text would have led some local authorities to ban all animal husbandry in their area.

Fishing is widespread over the whole W&W PPAs but practiced on a limited scale, mainly by women and children, and mainly in the dry season (January to April), when river levels drop and fishes concentrate in certain places. The fishing equipment is basic: mainly landing nets for the women and rods with hooks for the children. None of the people we interviewed mentioned any other equipment (such as casting nets, gill nets, fish traps, etc.), which does not mean that they are not used, but that they are probably little used.

Fish pond farming is known by some households and was practiced in the past, but the few fish ponds in operation seem to have been destroyed or abandoned during the war (1989-2003). A recent fish farming project, FishLib, implemented by the NGO APDRA, was active in the South of Zorzor but did not reach the W&W PPAs.

[4] https://www.fao.org/faolex/results/details/fr/c/LEX-FAOC174510/

7. Assessment of the vulnerability to climate change

An assessment of the vulnerability to climate change of the W&W PPAs was carried out in 2021 (DARROZE et al., 2021)[5].

Past climate data (1980-2020) were analysed, using local data from weather stations combined and crosschecked with data from the TAMSAT Project (Tropical Applications of Meteorology using SATellite data).

Projected climate estimates were analysed for the time horizons 2030 (period 2015-2045), 2050 (period 2035-2065) and 2085 (period 2070-2100), in comparison with the historical period (1980-2005). Estimates were produced (i) using global models from the Coupled Model Intercomparison Project Phase 5 (CMIP5) and CMIP5-Coordinated Regional Downscaling Experiment (CLIP5-CORDEX) ensembles; (ii) for RCP4.5 and RCP8.5 scenarios of the Intergovernmental Panel on Climate Change (IPCC), respectively the "most optimistic" and the "most pessimistic" scenarios in terms of projected greenhouse gases emissions.

Here below are summarized the key findings of this study:

Temperature: For the recent past (1980-2020), there is a trend towards an increase in maximum temperature of +0.32°C per decade, spread evenly across the region. The increase will continue: between +0.5°C in the short term (horizon 2030) in the RCP4.5 scenario and +4°C in the long term (horizon 2085) in the RCP8.5 scenario.

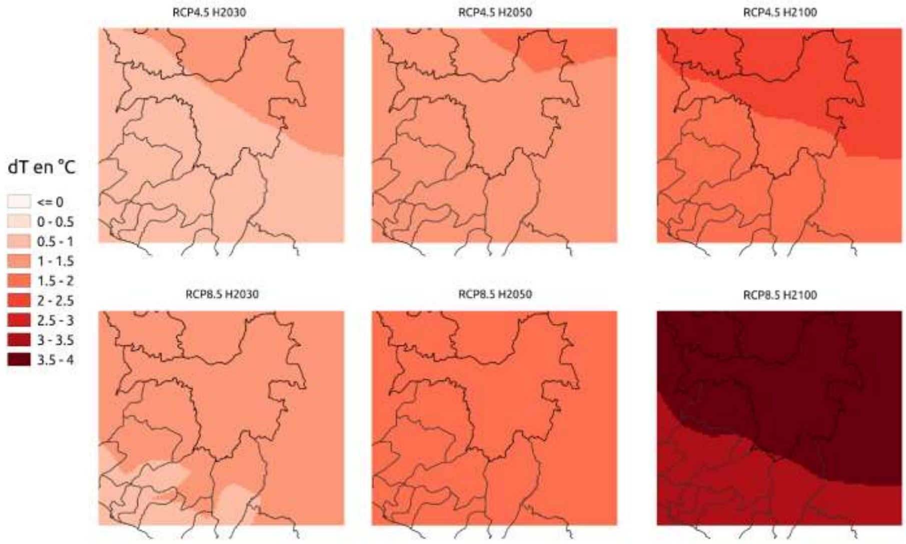

Figure 17 – Projected increase of mean temperature - Horizons 2030 / 2050 / 2085. Scenarios RCP4.5 & RCP8.5. CIMP5-CORDEX Ensemble (DARROZE et al., 2021)

Rainfall (NB: focus on Macenta, closest Guinean city to the W&W PPAs): For the recent past (1980-2020), the rainy season begins in early March and ends in mid-November, with an inter-annual variability of around ten days. It lasts an average of 270 days. There is no trend towards a shift in the start or end of the rainy season, or a shortening or lengthening of its duration. The average duration of dry periods ranges between 6 and 12 days, and the number of dry periods ranges between 1 and 9. These indicators vary greatly from year to year. However, there is no significant trend.

In terms of annual rainfall, the recent past average is around 2,500 mm/year. In the RCP4.5 scenario, there is no significant change in the future projections. In the RCP8.5 scenario, an increase in cumulative annual rainfall of 200 mm/year is projected for the 2050 and 2085 horizons.

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[5] DARROZE et al., 2021. Études de vulnérabilité et perspectives dans la gestion du complexe forestier de Ziama-Wonegizi-Wologizi (ZWW) – Libéria. AFD / Programme Adapt'Action – Paris. 111p

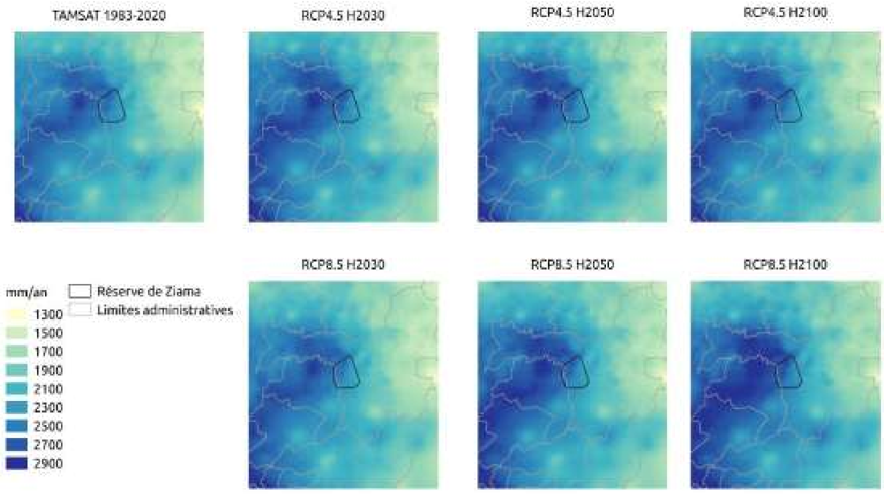

Figure 18 – Projected increase of annual rainfall - Horizons 2030 / 2050 / 2085. Scenarios RCP4.5 & RCP8.5. CIMP5-CORDEX Ensemble (DARROZE et al., 2021)

As this assessment was carried out 4 years ago, we analysed the most recent projected estimates, on the Climate information portal managed by the Swedish Meteorological and Hydrological Institute (SMHI)[6]. Indeed, estimates published on this platform are constantly updated, based on the latest outputs of global models in the CMIP5 and CMIP5-CORDEX ensembles.

Here below is a screenshot from the SMHI Platform, with key climate indicators for the long term, under the RCP8.5 (the most pessimistic scenario… and maybe the most realistic for now, given the overall low level of ambition of the NDCs), for the city of Konia, in the middle of the W&W PPAs. In short, these recent SMHI estimates corroborate the major trends identified in DARROZE et al., 2024.

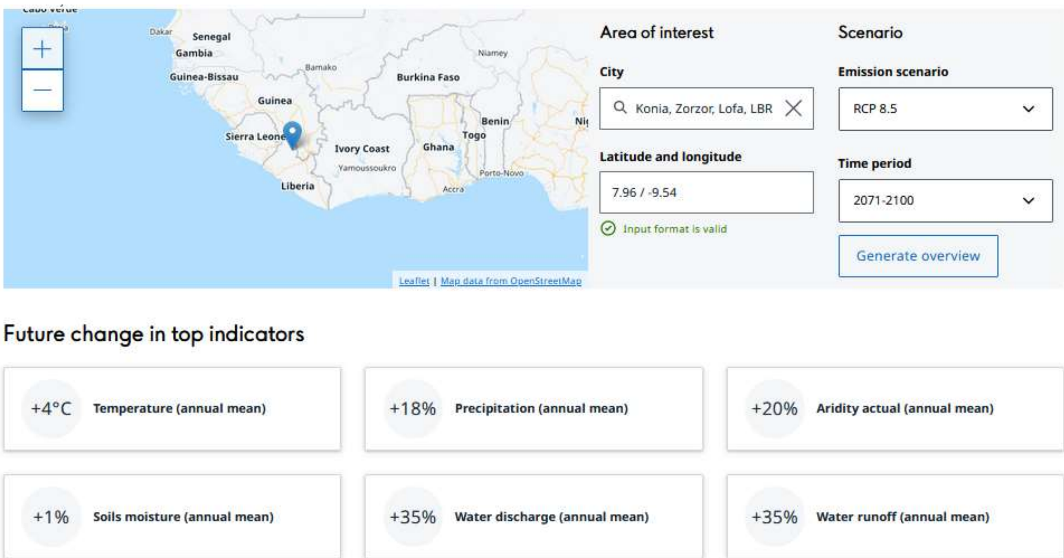

Figure 19 – Key climate indicators for horizon 2085, under the RCP8.5, for the city of Konia (SMHI Platform, 2024)

Conclusion:

(i) The major climate change in the area is the rainfall variability, especially the dry periods that directly threatens the rainfed agriculture. The modelled projections do not conclude on a significant trend, but many local interviewees said they had noticed a recent increase in these dry periods… This could be possible, as such dry periods are uneasy to model;

(ii) Very few (if no) technical adaptation measures are in place faced to this increase of dry periods. However, possible measures exist (e.g. reducing water demand through the promotion of crops and/or varieties that require less water, increasing water retention in the soil through mulching or crop cover, promoting lowland cropping, etc.).

[6] https://ssr.climateinformation.org/ssr?lat=7.961915&lng=-9.5438861&scenario=rcp85&period=p2&city=Konia%2C+Zorzor%2C+Lofa

8. Synthesis of social, economic, and environmental challenges

Simulation of a household production unit and its level of rice self-sufficiency: Considering a "standard household" of 7 members with 3 persons able to work full time on their farm while also taking part in group works ("ku"), the upland cultivated area averages 1.3 ha of rice and mixed crops. If we assume that this household also has access to a small "swamp" (half an acre), its total annual rice production in a normal year would be around 1.7 ton of paddy.

If we deduct post-harvest losses (around 5%, or 85 kg) and seeds saved for the following year (around 3%, or 50 kg), and then assume a conversion rate of 67% at hulling, the total quantity of rice available is around 1 ton. The amount of rice used to prepare meals for workers during group works is difficult to estimate, but could be around 100 kg (with the following assumptions: i) about 40 days of contract work with 10 workers each; ii) average consumption of 250 g of rice per person per meal; iii) exchange of work and meals through "ku" system not taken into account since it is mutual).

The remaining 900 kg of rice barely covers the needs of this household of 7 people, given an average consumption of 133 kg of rice per person per year (FAO, EU & CIRAD, 2024)[7]. **This means that there is no rice surplus in a normal year, and that to cope with production shocks or anomalies, the household will have to resort to rice purchases.**

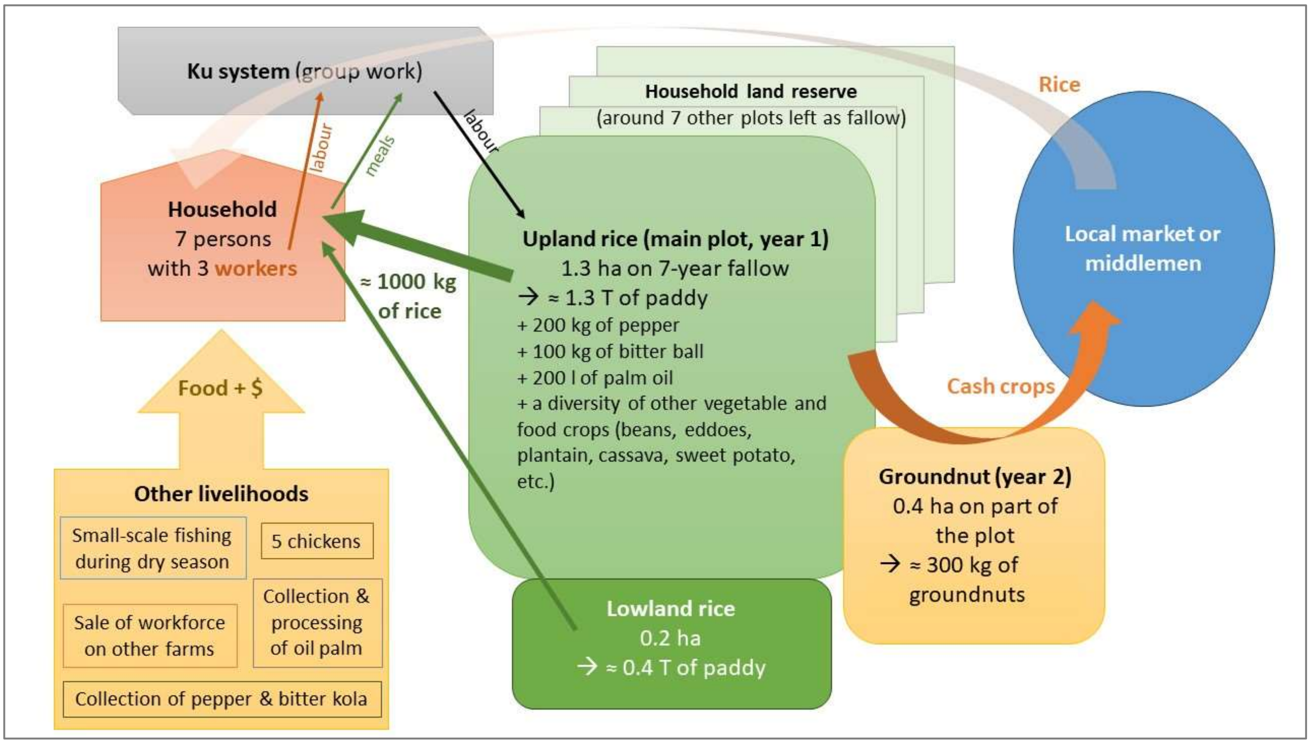

Figure 20 – Diagram of a standard household in W&W area, its farming system and other livelihood strategies (authors, 2024)

Key socio-economic challenges: Due to the low population density and currently unrestricted access to land and forest resources, the predominant system of rain-fed rice cultivation on slash-and-burn is still relatively efficient and enables households to meet their basic food needs. The few cash crops and NTFPs generate cash income, which is used by households to make up the rice shortage during the lean season.

There are no obvious signs of exhaustion in this cropping system: fallow land is still relatively long (7 years on average), there are few invasive weeds and soil fertility is considered good, except in the immediate vicinity of villages. Firewood comes mainly from upland farms (cleared plots) and is available freely and in abundance.

Nevertheless, this shifting cultivation system goes on by encroaching a little more each year on the forest area.

[7] FAO, European Union & CIRAD, 2024. Food Systems Profile – Liberia. Catalysing the sustainable and inclusive transformation of food systems. Rome, Brussels and Montpellier, France. https://doi.org/10.4060/cd0246en

Complementary subsistence activities exist but are practised on a small scale and essentially for self-consumption. In particular, small-scale livestock farming is underdeveloped. There seem to be several obstacles to animal husbandry, but they are not insurmountable.

With the exception of joint farming groups ("ku" system) and self-help groups (for savings and loans), farmers are not well organised and access to credit is limited. Equipment for processing agricultural products is rudimentary and few in number.

Market access is made difficult by the remoteness of the area and the state of the main road, particularly in the rainy season. Trade in local produce is partly directed towards Guinea. Farmers have little control over selling prices.

Industrial timber exploitation is still non-existent in the area (with the exception of the sawmill in the Bluyeama community forest, which is currently shut down). Pit sawing is still limited.

Living conditions remain precarious in W&W PPAs, in terms of housing, material goods, access to drinking water and basic social services. Even if complementary strategies are used to limit the hunger gap, food security remains fragile and subject to shocks (e.g. droughts, price fluctuations, etc.).

Key environmental challenges: As stated in the conclusion of Part 4: "*if a farmer has the capacity to mobilise enough internal workforce (household) and/or to afford external workforce (contract and/or ku), he will tend to favour the upland rice cropping on forest. As there are no physical obstacles (accessible land, now and in the years to come, given the very low population densities) or technical-economic obstacles (good profitability) to growing upland rice on forest, apart from the ability to bear the production costs of this system, there is no reason why this practice should diminish in the future*".

This means that, as long as alternative technical itineraries have not been proposed to farmers, tested with them and fine-tuned to their needs with a view to scaling them up, the environmental damage associated with slash-and-burn will continue: habitat degradation and loss of connectivity for biodiversity, soil erosion, excessive water run-off, GHG emissions, etc. According to our Google Earth analysis (see figure infra), 16% of the total land area of W&W PPAs and the Bluyeama CF can be considered as "agriculture land" (plots in production or degraded forest / fallows), and there is no any reason this % will not raise.

	Wonegizi PPA	Wologizi PPA	Bluyeama CF	Total (W&W PPAs + B CF)
Total area (ha)	27 594	99 538	49 444	176 576
Agric area (ha)	9 100	15 700	3 800	28 600
% of agric land	33%	16%	8%	16%

Figure 21 - % of agriculture land in the W&W PPAs and the Bluyeama CF (authors, 2024)

Alternative technical itineraries could focus on the 2 main cropping systems: (i) upland rice cropping with associated crops: maintaining soil fertility and controlling weed pressure to lengthen the cropping cycle (and lessen the need for new slash-and-burn on upland); (ii) lowland rice cropping: increasing and sustaining rice production in the long term to lessen the need for new slash-and-burn on upland.

Here below are some rough and preliminary estimates of GHG savings allowed by agroecological intensification:

- **Upland farming:** Assuming
  - It is assumed that the same household returns to the same slash-and-burn plot a maximum of 3 times to grow rice (in rotation with forest fallow) before clearing primary forest again, i.e. a total cycle of around 24 years. This plot is abandoned when the soil fertility is too low and/or weed pressure is too high. In details: rice with other crops Y1, groundnut Y2, fallow Y3 to Y8, then rice with other crops Y9, groundnut Y10, fallow Y11 to Y16, and lastly rice with other crops Y17, groundnut Y18, fallow Y19 to Y24;
  - The GHG emissions are at least equal to the clearing of the natural forest in Y1, i.e. 627 $t_{eq}CO_2$/ha (FFI & NORAD, 2019)[8], not taking into account the GHG emissions due to the clearing of fallows in Y9 and Y17;

[8] FFI & NORAD, 2019 - Wonegizi REDD+ Project: Baseline Carbon Stock Report

- The rice production (not taking into account the production of other crops) is equal to 2.1 t/ha of paddy in Y1 and then 0.9 t/ha in Y9 and Y17 (see part 4), i.e. 3.9 t/ha over the full cycle. In other words, In other words, the "standard" productivity of a 1-ha upland plot over the full cycle is equal to 3.9 t of paddy / 24 years = 0.16 t/ha/year of paddy.

Then, the "standard" carbon balance over the full cycle is 627 $t_{eq}CO_2$/ha for 3.9 t/ha of paddy, i.e. 161 $t_{eq}CO_2$/t of paddy. With an agro-ecological intensification itinerary (improved fallows with continuous crop cover and/or mulching and/or use of nitrogenous-fixing plants or trees), it seems realistic to try to achieve a 2nd year of rice in each of the 3 cycles and hope to achieve at least the rice yield after fallow (0.9 t/ha). Then, the rice production would be equal to 2.1 t/ha of paddy in Y1 and then 0.9 t/ha in Y2, Y9, Y10, Y17, and Y18 (see part 4), i.e. 6.6 t/ha over the full cycle.

The "improved" carbon balance would then be 627 $t_{eq}CO_2$/ha for 6.6 t/ha of paddy, i.e. 95 $t_{eq}CO_2$/t of paddy, 40% lower than the "standard" carbon balance.

- **Lowland farming:** Assuming a "standard" cycle of cropping where rice is cropped every year on the same lowland, without any development (no drainage, no water control), the annual rice production would be equal to 1.8 t/ha of paddy (see part 4).

The corresponding "standard" carbon balance could be estimated at least at 8.3 $t_{eq}CO_2$/ha [taking into account the sole CH_4 emissions, without taking into account the CO_2 and N_2O emissions, more marginal. Hypothesis: continuous rice cropping, year after year; permanent flooding, including 30 days before sowing; rice straw exported at harvest] (SalvaTerra, 2023)[9].

Then, the "standard" carbon balance is 8.3 $t_{eq}CO_2$/ha for 1.8 t/ha of paddy, i.e. 4.6 $t_{eq}CO_2$/t of paddy (NB: it is worth noting it is 40 times lesser than the "standard" carbon balance for upland rice cropping).

With an agro-ecological intensification itinerary, it seems realistic to try to achieve a 2nd cycle of rice per year (thanks to an improved water management allowing cropping at the end of the rainy season and short-cycle rice seeds) and/or an increase of the yield (thanks to a better water level management allowing alternate wetting and drying (AWD), and simplifying weed control), without aggravating the carbon balance (and even, at the contrary, as CH_4 emissions would be reduced with AWD techniques). All in all, it seems realistic to achieve a 50%increase of annual production, i.e. + 0.9 t/ha or 2.7 t/ha in total.

This 50% increase of 0.9 t/ha of paddy production in lowland, with a carbon balance of 4.6 $t_{eq}CO_2$/t of paddy, could replace the same volume of production in upland, with a "standard" carbon balance of 161 $t_{eq}CO_2$/t of paddy. In conclusion, a 50% increase of lowland rice production could allow:

- A "GHG savings" of 161 – 4.6 = 156.4 $t_{eq}CO_2$/ha,
- A "forest savings" of at least 5 ha: the "standard" upland productivity over the full cycle is equal to 3.9 t/ha of paddy / 24 years = 0.16 t/ha/year of paddy; the "improved" lowland productivity is 0.9 t/ha/year; the "forest savings" in terms of ha is equal to 0.9 / 0.16.

9. Conclusion: proposed key actions based on the assessment

Result 5 - Supporting communities in implementing concrete social development initiatives

Basic needs such as access to water, health and education are particularly acute in the villages surrounding the future PPAs, as well as the Bluyeama FC. Previous actions and projects have had no tangible impact on the living conditions of the local population.

To ensure the support of a majority of the population and thus strengthen the involvement of villagers in the forest conservation process, as recommended in particular in (CST, 2024)[10], particularly women, it is recommended to promote the implementation of concrete social investments in each

[9] SalvaTerra, 2023. Riziculture irriguée et changement climatique : *Approfondissements méthodologiques pour la finance climat et la contribution aux trajectoires long terme AFOLU bas carbone et résiliente.* Livrable 1.1 – Synthèse bibliographique. Rapport produit pour le COSTEA, l'AFEID et l'AFD. Paris – SalvaTerra. 33p

[10] Comité scientifique et technique (CST) forêt, 2024. Enjeux de l'implication des populations locales dans les initiatives de restauration forestière en Afrique centrale. Note de politique n°4. 4p

village, typically the improvement of basic infrastructures (development/protection of water wells, rehabilitation of primary schools or clinics, etc.).

These actions should be carried out as a priority at village level, in the form of micro-projects selected and implemented in a participatory manner.

Result 6 - Supporting farmers in adapting and sustaining their upland cropping systems to contain forest cutting fronts

Forests can only be protected from further clearing if farmers adopt alternative cultivation practices.

Given the local economic, technical and environmental conditions (in particular the presence of fragile soils on sometimes steep slopes and in a humid tropical climate), it is not feasible in the short and medium term to promote permanent cropping systems on uplands (need for substantial external inputs to maintain soil fertility, high risk of soil erosion if ploughed, etc.).

It is therefore essential to work with farmers to identify simple techniques that have already been tried and tested elsewhere, which will reduce the need for further clearing, while maintaining soil fertility and avoiding weed development on upland fields.

This could involve developing agroforestry practices based on those that already exist, such as preserving oil palms or other useful species on cultivated plots. The introduction of improved fallows and farmer-assisted natural regeneration is another interesting approach. These various techniques could make it possible to exploit species that are already known to local populations and that are useful to them, either as a source of food (e.g. pigeon pea) or for other uses such as timber or NTFPs.

Result 7 - Developing lowlands to increase rice yield and strengthen household food security

Although probably modest, there is potential for developing rice lowlands in the area.

Developing these lowlands would improve water control/drainage by avoiding periods of flooding or prolonged drought. This would make it possible to permanently increase the area under cultivation, significantly increase rice yields and even double the number of annual cropping cycles (rice/rice or alternating rice with vegetable crops during the dry season, for example).

The lowland rice fields could also be combined with fish farming by setting up small dam ponds.

Given the local conditions of access, the small size of the plots to be developed and the need for the farmers themselves to take ownership of the developments and make them sustainable, strong emphasis will need to be placed on i) simple, low-cost technologies, enabling easy maintenance of the works; ii) making the most of local resources, including in terms of labour to carry out the lowland developments.

Result 8 - Promoting innovative, alternative livelihoods to diversify the sources of food and income

Local people combine different livelihood strategies to meet their needs, particularly during periods when there is less farm work. For many, these activities are carried out on a small scale, for various reasons including lack of financial resources, technical knowledge or access to reliable outlets.

To support these activities (e.g. livestock farming, improved poultry farming, NTFPs processing, dry-season gardening in enclosed plots, etc.) , a demand-led approach should be adopted, and adapted to the specific conditions of each village or each household.

This could take the form of seed capital contributions from the project, on-the-job training to improve/develop beneficiaries' skills, and sustained monitoring and ad-hoc technical or economic advice from project staff and partners (including local NGOs).