THE ECONOMICS OF LAND DEGRADATION

Policy Brief

Agroecological farming in Haiti: A poverty crisis solution

1. Introduction

Haiti is currently considered the poorest country in Latin America and the Caribbean. Its people suffer from a food security and poverty crisis. In rural areas, up to 90% of Haitians are living below the poverty line and currently 4.3 million Haitians are in need of immediate food assistance (IPCinfo 2022). It was recently ranked in the world's worst 10 hunger crises (FAO 2022). Since 2009, agroecological practices have been implemented in the Northern Plateau of Haiti, with the support of Partenariat du Developpement Local, an NGO. Based on research within the districts of Pignon, Saint Raphael and Mombin-Cochu, it is found that the scaling-up of agroecological model farming would result in a significant economic infusion into rural economies, improvements in livelihoods and enhanced climate resilience.

Key messages for policy makers:

- The adoption of agroecological model farming leads to impressive increases in productivity and a doubling of per hectare profitability in the Northern plateau of Haiti.
- Additionally, these agroecological practices can increase water retention and carbon sequestration in the soil, reduce topsoil losses and mudslides, and increase food security.
- Farmer-centered and decentralized agricultural innovation, extension and development needs to be supported.

Farmers building stone soil conservation barriers.
Photo by Cantave Jean-Baptiste.

WHAT IS AGROECOLOGY?

The Haitian NGO *Partenariat pour le Développement Local's (PDL)* work is rooted in principles of agroecology, initially defined as *the application of ecological concepts and principles to the design and management of sustainable agroecosystems, or the science of sustainable agriculture* (Gliessman, 1990, 1997, 2018). Today, the definition of agroecology has grown to become *the ecology of the entire food system* (Francis *et al.*, 2003), which integrates research, education, action and change that brings sustainability to all parts of the food system (Gliessman, 2018). Central to agroecology is the agency of farmers and their organisations to experiment, innovate, adapt, and spread agroecological principles and practices to local ecosystems. It is thus the process of agroecological, farmer-focused research and development, as much as any specific set of techniques, that is prioritised.

The agroecological farming strategies promoted by PDL build on existing farmer knowledge and practices (e.g., qualities of local crop varieties, diversification, seed saving) while also fostering farmer-to-farmer learning and changes to existing farming practices (e.g., stopping the conventional practice of "slash and burn" and introducing soil conservation). As alternatives, farmers test and promote a combination of agroecological techniques that address five major issues: control of soil erosion (e.g., contour barriers); increasing soil organic matter and fertility (e.g., composting and use of manure, integration of crop residue instead of burning, maintaining cover, fencing to protect against free grazing livestock); improving access to and management of quality seed (seed selection, community seed banks, using fewer seeds per hectare); improved on-farm crop diversity and management (inter-cropping, rotation, optimal plant spacing,); and improved plot maintenance (e.g., through timely weeding, control of local pests and diseases, etc.).

- Agroecology can be incentivized through regulatory and economic instruments, such as markets for environmental service, ecological fiscal transfers, targeted subsides for input and assets that are critical to farmers ability to adopt agroecology.
- Scaling agroecology will require collaboration between private sector investors, community-based NGO's, and farmers, as well as blended finance solutions, to mobilise resources and disseminate knowledge.

2. Case study area and data collection

The policy brief concentrates on three communes within Northern Haiti where PDL has been working since 2009 (figure one). The Communal Sections, notably, Bois Neuf, Sans Souci and La Belle-Mère were chosen to assess the role of agroecological farming across different cropping systems (communities either specialised in beans or sugar cane). Each communal section has its own peasant association that provided a full list of association members, including model[1] and conventional farmers. Data sampling for the study was derived from this list.

Qualitative (three focus group discussions) and quantitative (household survey) data were collected from October to July 2021. Over 330 households were interviewed, on the basis of a stratified representative sample of agroecological model and conventional farming within each of the three communal sections, from the

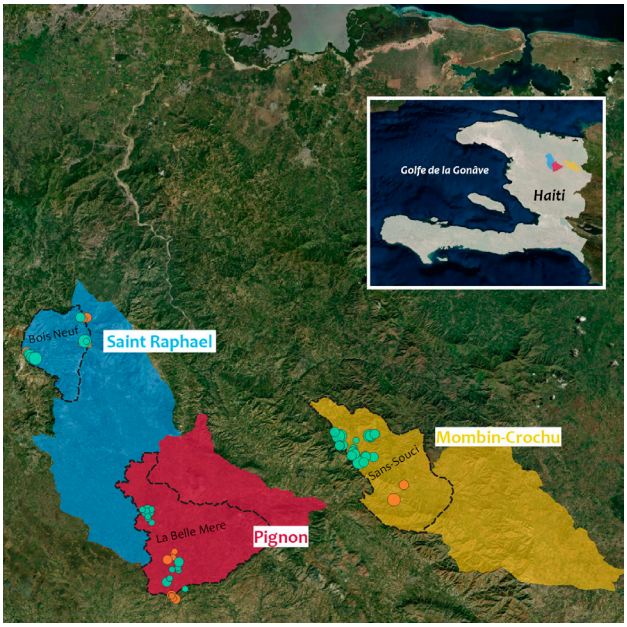


Figure 1: Case-study area, municipalities, and municipal sections. Sampled model farming plots are green, and sampled non-model farming plots are orange (credit: Luis Costa)

1 A model farmer is defined by peasant associations, as a farmer that adopts several agroecological principles and practices.

list of association members[2]. The municipal sections count a total population of approximately 30,000 people (5,000 households[3] and 3,000 peasant association members). As such, the results presented in this brief are representative of members of peasant associations (agroecological farmers or not) and not the entire population. The objective of the survey was to assess per hectare incomes of agroecological and conventional farmers, using carefully designed land use budgets to elicit differences in farming practices, the use of inputs, production quantities and prices for all inputs and outputs.

3. Scope of Problem

Haiti is experiencing a poverty and food security crisis. Almost 90 percent of the rural Haitian population live below the poverty line, and food insecurity is high. According to the United Nations World Food Program Haiti currently has 4.4 million Haitians in need of immediate food assistance, amongst this, 1.2 million suffer from severe hunger – one of the highest levels in the world. In rural communities, agriculture accounts for up to 25 percent of Haitians' income (World Economic Forum (WEF), 2011; Bargout and Raizada, 2013), and accounts for 25 percent of the gross domestic product (GDP) (Singh and Cohen, 2014), however, little investment, policy and infrastructure support has resulted in the decline in food production, a lack of growth in the agriculture sectors' economic contribution, and an increase in food insecurity.

The decline in productivity is closely linked to several controllable factors, some of which include:

- poor infrastructure that supports the production, storage, transport, and marketing of local agricultural products (Murray and Bannister, 2004; Bellande, 2010; IFAD, 2022)
- increased urbanisation resulting in a reduced labour force, due in part, to a lack of efforts to revive, sustain and grow the agricultural sector, reflected for example, in the near absence of farmer assistance programs and extension services[4]
- inaccessibility of suitable financing options, credit and saving cooperatives (Beaucejour, 2016)
- land tenure and lack of long-term security, reducing incentives for farmers to invest in long term soil fertility (LeFranc, 2021)

These factors are compounded by climate hazards, political instability, depreciation of the Haitian gourde against the US dollar (Famine Early Warning System Network, 2022) and the deterioration of soil quality for farming (Groundswell International, 2017).

In Northern Haiti, approximately 145,000 farm households depend on agriculture (Molnar et al., 2015), however reduced land productivity further decreases income generating capabilities and household food security. The problem stems from a long history of social exploitation and ecological extraction. Current issues exacerbate the situation, including poor coordination between funding and government programs, infrastructure and extension services (Murray and Bannister, 2004; Bellande, 2010; Groundswell, 2017) and poor orientation of international development programs. Moreover, there is evidence that the international aid and trade regime that pushed to liberalise Haiti's economy has undercut the country's domestic production and fostered an over reliance on (subsidized) food imports, such as subsidized rice and poultry from the United States (Gros, 2010; Wisner, 2022). Today, 80 percent of rice, all cooking oil, and nearly half of all the food consumed in Haiti is imported (FEWS NET 2021).

In the light of these challenges, *Partenariat du Developpement Local* (PDL) has worked since its inception in 2009, and based on over 35 years of prior experience of its founder Cantave Jean-Baptiste, to strengthen rural communities and peasant associations across the north of Haiti's Central Plateau basin, with the vision that enhanced rural prosperity is a key cornerstone for revitalizing the entire country.

4. Results - What happens when farmers use agroecological practices

Farmers in the study have between 0.5 and 4 hectares (ha) of arable land with an average of 1.6 ha. For farmers implementing agroecological 'model' farming strat-

2 As a rule of thumb, minimum 300 observations are needed to reach a 95% confidence level for sample statistics of population sizes of 1000 or more. (Angelsen et al., 2014)
3 Assuming there is an average of 6 members per household as revealed in the household survey
4 https://country.eiu.com/article.aspx?articleid=866651470&Country=Haiti&topic=Economy

egies, one third is typically dedicated to model farming and two thirds to conventional practices. The adoption of agroecology is primarily done as a resilience building and income diversification strategy (Gustave, 2021). See e.g. an extract from focus group findings in La Belle-Mère (box 1).

While both model and conventional farmers undertake some agroecological practices model farmers intercrop an average of five different crops per model plot over a year, whereas conventional farmers average three crops per plot in a year (Table 1 on page 4).

The main crops grown in the three communities are black beans, maize, pigeon peas, cassava, sugarcane, and banana. In La Belle-Mère farmers reap a large share of their income from the cultivation of sugarcane, whilst in Bois Neuf and Sans Souci, farmers main crops are black beans and pigeon peas. Gross income from the sale of these crops in the communal sections are shown in Table 2. Farmers also have a range of trees on their farms. Main forest products include coconut, cashew nuts, lemon, orange, mango, avocado, corossol (soursop) and cachiman (custard apple). Total gross income from the sale of the forest products grown amongst model farmers range from an average of 124 $US/ha[5] in Bois Neuf and Sans Souci to 233 $US/ha in La Belle-Mère[6].

Expenditures by both conventional and model farmers are largely related to the purchase of seed, rental of ploughing equipment, saplings, and hired labour. Aver-

BOX 1: FOCUS GROUP FINDINGS FOR MODEL FARMING

In La Belle-Mère, participants highlighted that the planting of avocado trees on the model farming plot allows for the sale of wood and avocados. They also serve as windbreaks for crops, aid in the fight against drought, and the tree leaves provide fertilisers for the soils.

"You can earn more money; plants are bigger and resist droughts better"

Table 1: Degree of intercropping - number of crops grown within the model and conventional farm plots, in the 12 months preceding the interview

Bois Neuf, Sans Souci and La Belle-Mère	Average number of crops	min	max
Model farmers	5	2	9
Conventional farmers	3	1	4

Table 2: The average per hectare net income estimates for model and conventional farmers in Le Belle-Mère, Bois Neuf and San Souci

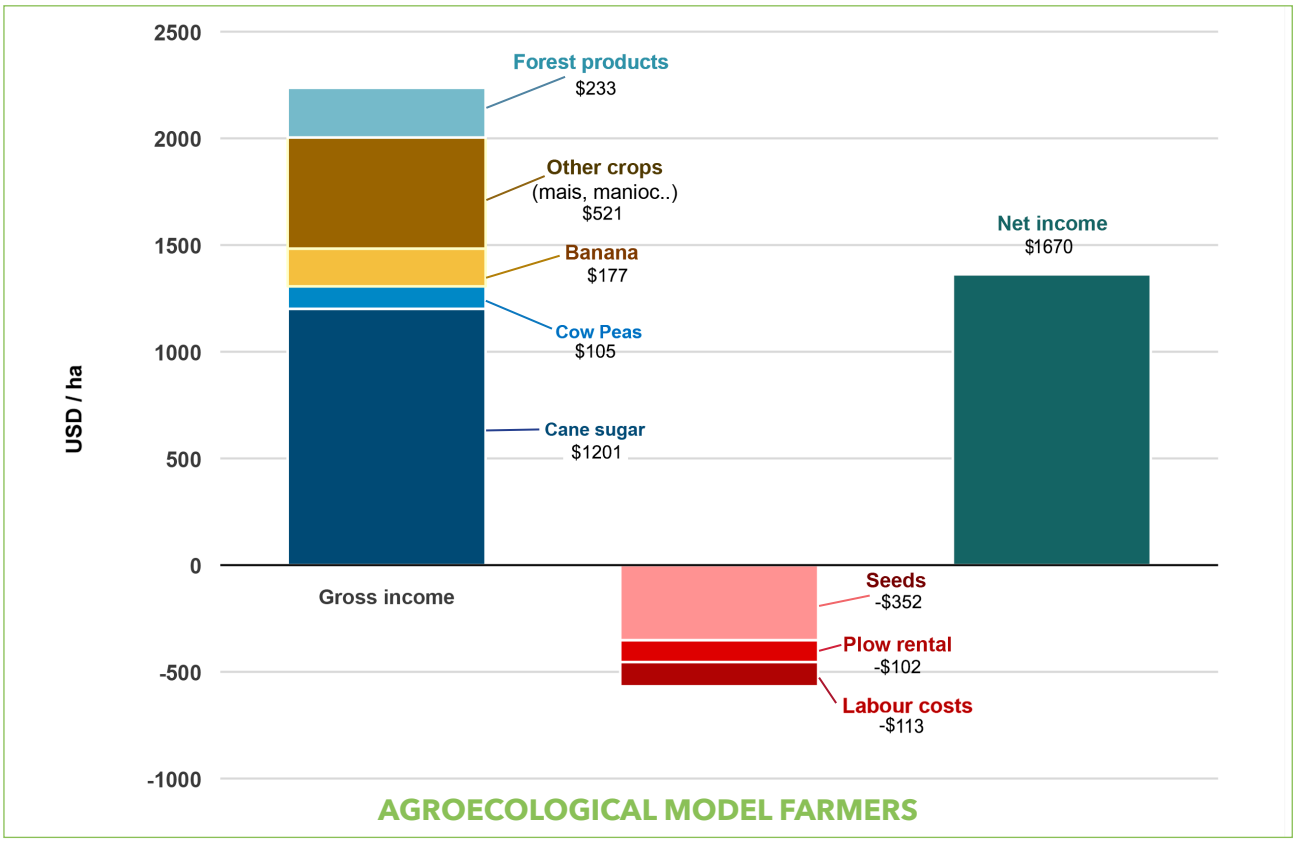
	La Belle-Mère		Bois Neuf & Sans Souci	
	Agroecological Model farmers	Conventional farmers	Agroecological Model farmers	Conventional farmers
Average gross crop income (USD/ha)	$2,004	$800	$1,552	$882
Average gross forest income (USD/ha)	$233	$128	$124	$35
Input costs (USD/ha)	$454	$85	$294	$203
Labour costs (USD/ha)	$113	$37	$136	$99
Average net crop and forest income (USD/ha)	**$1,670**	**$806**	**$1,246**	**$615**

*Hired or family labour costs for ploughing, weeding, harvesting, planting and agroecological soil conservation barriers; Input costs include seeds, tree seedlings and rental of ploughs. La Belle Mère is more flat land with higher demand for ploughing.

5 Based on: 1 Gourdes = 0.0139 USD, December 2020.

6 These are likely to be lower bound estimates of the true benefits, as a large share of the produce is enjoyed by households (from 15% for oranges to 25% in the case of Mangoes) for subsistence purposes and are therefore more difficult to recall. Moreover, fuelwood harvests for charcoal production and the value of timber are also left out of the analysis

age labour costs are in the order of approximately US$4 per day. In terms of net income per hectare farmed, one can see a significant difference between agroecological model and conventional farmers. The average net income from model farm plots is almost double that which conventional farmers obtain. This difference is illustrated graphically in Figure 2 for farmers in La Belle-Mère.



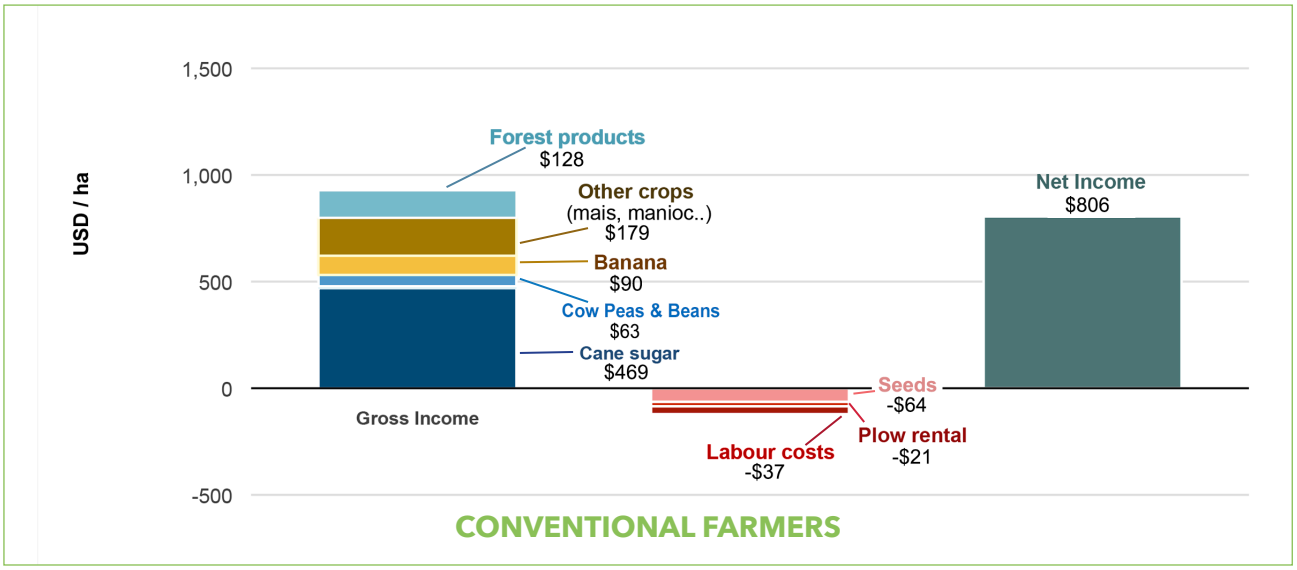


Figure 2: Bi-variate comparison of farm income and production costs of an agroecological model farmer (LHS) compared to that of a conventional farmer (RHS) in La Belle-Mère.

4.1. Differences in land productivity explained

It is important to acknowledge potential differentials that are not controlled for in simple bi-variate comparisons. For example, model farmers may be more productive because: their farming plots are located closer to their homestead; they are better educated; they have greater support networks; they use a more efficient level of conventional farming inputs in addition to adopting agroecological practices. To control for all the variables that may be driving the observed income differences, further statistical analysis was undertaken, which confirmed and explained the observed income differentials (Table 1A in Appendix of report).

It showed that:

- Education, supporting networks[7] and distance from the main plot to the household were not statistically significant determinants of land use productivity.
- Agroecological model farmers spend more on hired labour and seeds, which partly explains why they have higher land use productivity and gross crop incomes.
- However, even when controlling for input use, agroecological farming still increases gross crop income. When holding everything else constant, a typical agroecological farmer has a gross crop income that is US$437 per hectare higher than an average conventional farmer.
- Intercropping is the main driver of increased land productivity amongst model farmers, e.g., if a farmer increases multi-cropping from 2 to 6 crops per ha for a given parcel of land over one year, expected gross crop income rises from US$700 to US$1,680[8] per hectare, see Figure 3.
- Model farmers, however, also have higher incomes than conventional farmers because they spend more on critical inputs (in particular, seeds, labour for weeding)

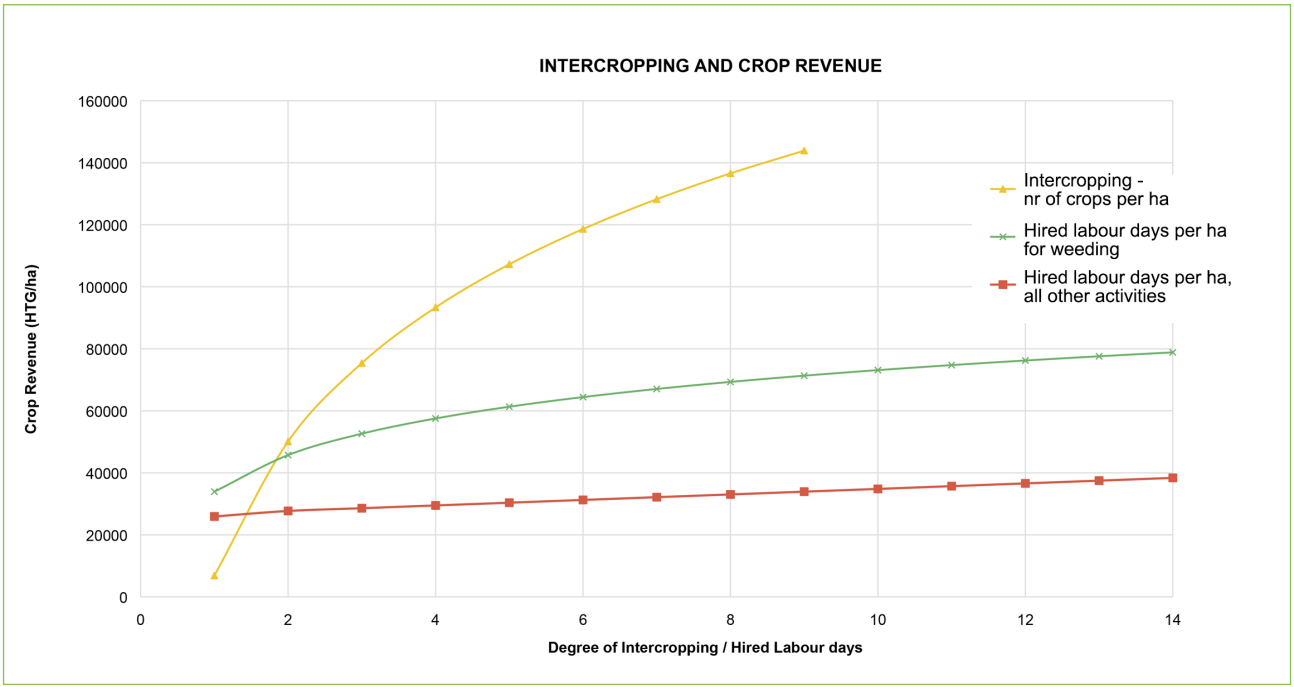


Figure 3: Correlation between the degree of intercropping and hired labour days with crop revenue

7 Recall, that all the interviewed farmers are part of farmers associations, so it can be expected that they are all reasonably well-supported.

8 based on 1 Gourdes = 0.0139 USD in December 2020.

BOX 2: INTERCROPPING AS EXPLAINED BY PDL

The term "Intercropping" captures the number of different crops that a farmer grows on a given plot of land for any one year. The goals of intercropping are usually to manage soil fertility (e.g., combining legumes, cereals, root and tuber crops, and trees) to improve food and biomass production, and to vary and extend the harvest period of different crops throughout the year, thus improving food access and security. The land use diversification strategy thus combines elements of mixed intercropping (component crops are totally mixed in the available space), temporal intercropping (the practice of sowing faster- and slower-growing crops that can be harvested at different times of the year), and agroforestry (integrating trees into farming systems). Figure 4 provides an example of intercropping and diversification of a typical plot of land on a model farm for a whole year. It may be compared to Figure 5, illustrating the typical cropping cycle of a conventional farmer.

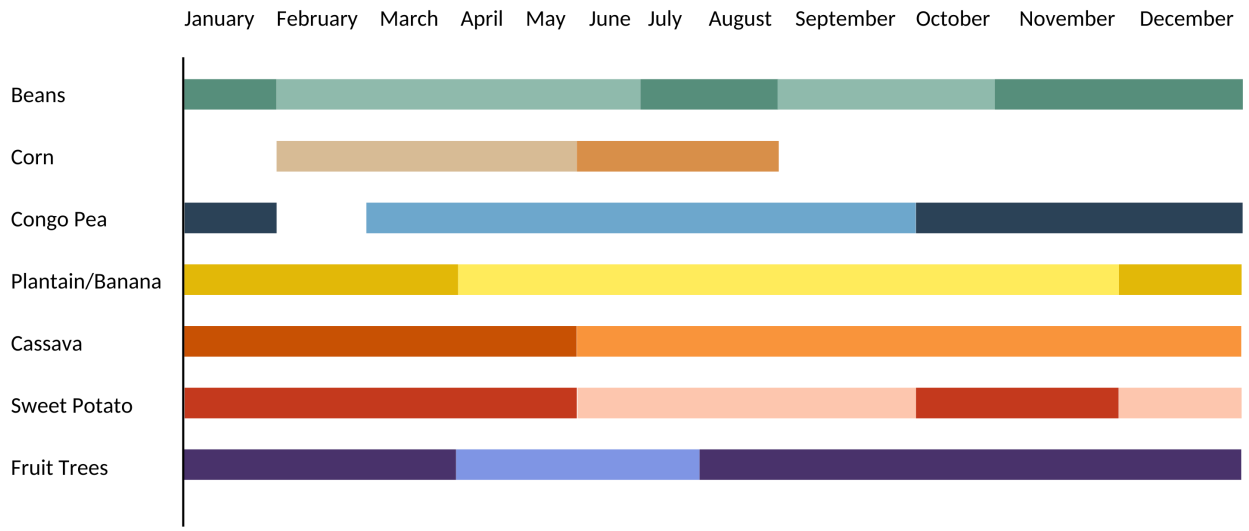


Figure 4: Typical crops found on a plot of land held by a model famer in Bois Neuf or Sans Scouci, where the light colour is a production month, and the darker colours are harvest months.

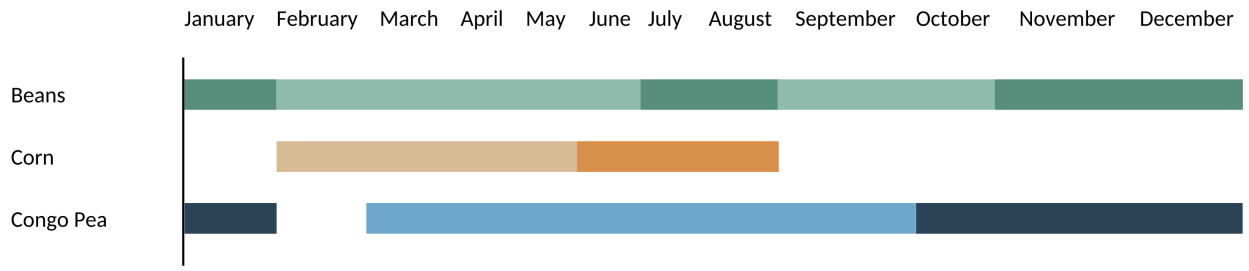


Figure 5: Typical crops found on a plot of land held by a conventional famer in Bois Neuf, where the light colour is a production month, and the darker colours are harvest months.

Agroecological farmer on his diversified plot.
Photo by Ben Depp.

Importantly, farmers were asked about their perception of agroecology and the changes in productivity.

Empirically the findings clearly demonstrate that model farmers can reap higher net-income per hectare of land dedicated to agroecological model farming, relative to conventional farmers, despite higher production costs. These findings, however, are irrelevant if the people implementing these changes do not perceive the benefit. Outcomes of the study validate the economic analysis. Surveys found that, in comparison to farmers using conventional farming methods, of those who implemented agroecological farming practices one third reported a 33% increase, half experienced a 50% increase, and 10% reported doubling their agricultural production during the study period. Most notably, an overwhelming majority (98%) state that they will continue to undertake agroecological farming, and 98% also plan to expand the area they have dedicated to model farming.

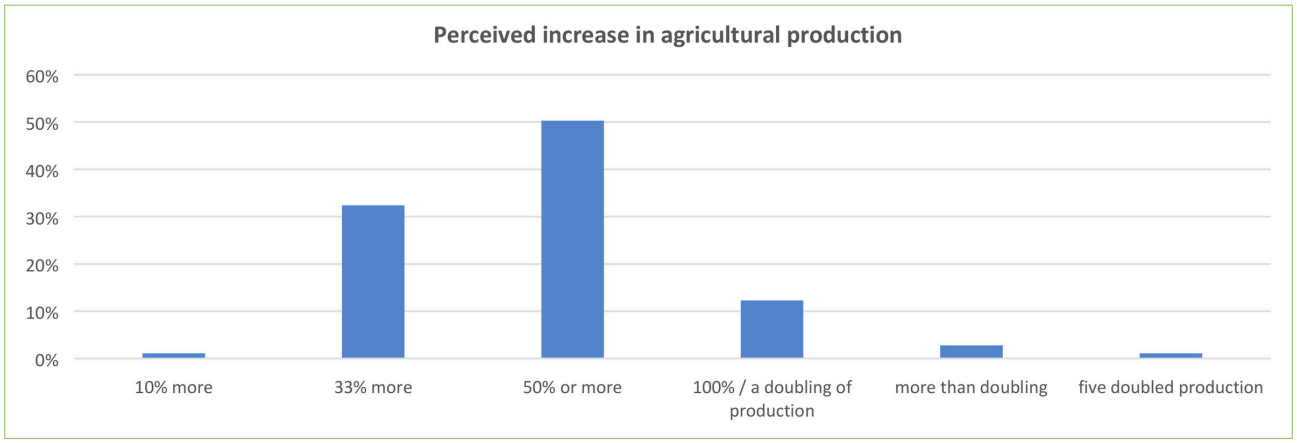


Figure 6: Perceived increase in agricultural production since adopting model farming.

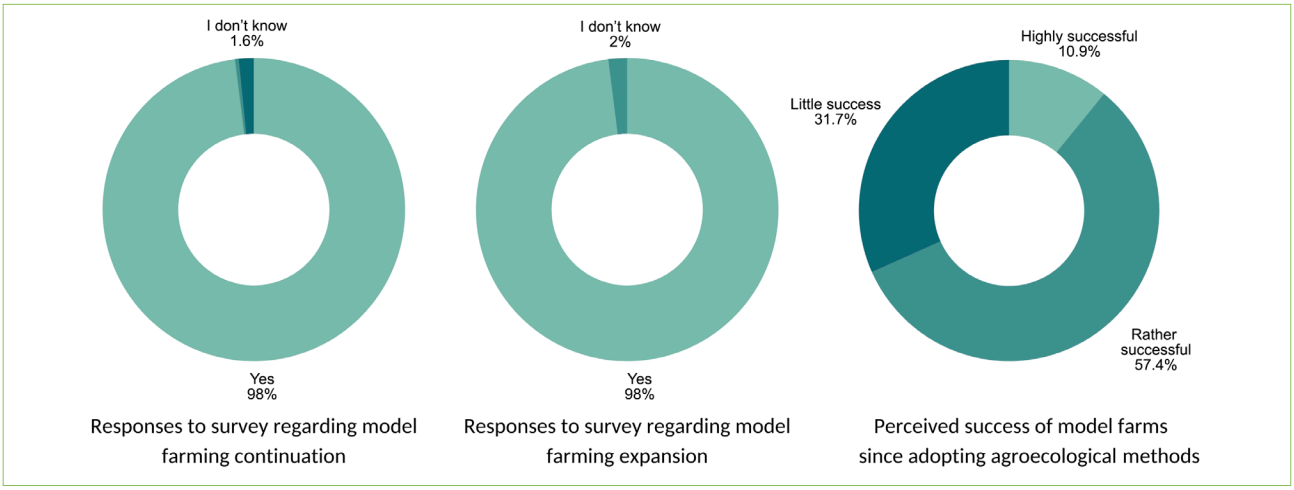


Figure 7: Responses to the survey regarding model continuation, expansion, and perceived success.

4.2 Validating climate resilience and land productivity with earth observations

Satellite imagery further validated the empirical household data regarding climate resilience. As shown in Figure 8, agroecological model farmers have statistically higher land productivity, as measured by Normalized difference vegetation index (NDVI). We compared values of NDVI (Copernicus Sentinel 2021) and precipitation (ERA5 2021) for the years 2019-2021.[9] Over that time period monthly values of NDVI were on average 4.3% higher for model farmers than in conventional plots (indicating higher fractions of vegetation). This was true even though agroecological model farms studied received on average 3.5mm *less precipitation* per month in comparison to conventional ones. This satellite data suggests that agroecological farming plots are characterized by higher land productivity and climate resilience, which is in line with ground-sourced survey findings of higher net crop incomes.

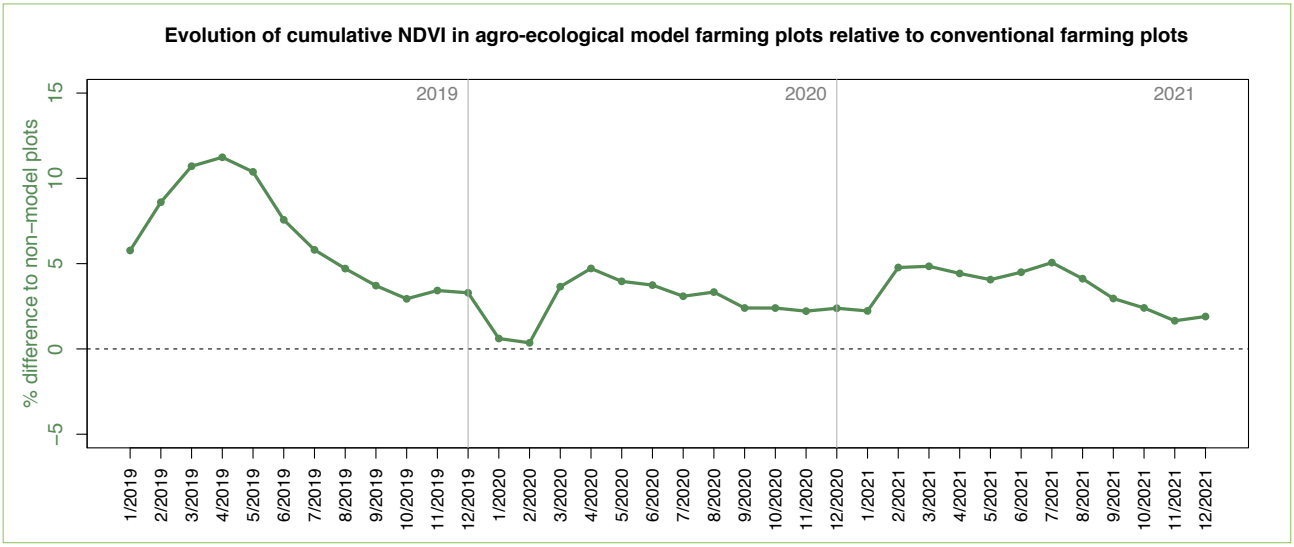


Figure 8: Evolution of cumulative NDVI (land productivity) within agroecological model farming plots relative to conventional farming plots.

9 Copernicus Sentinel data (2021). Retrieved and processed from GEE.
ERA5 (2021) Fifth generation of ECMWF atmospheric reanalyses of the global climate. Copernicus Climate Change Service (C3S), Climate Data Store (CDS), https://cds.climate.copernicus.eu/cdsapp#!/home

5. A plan to implement sustainable agroecological land management in Haiti

Considering the results above, it is of utmost importance for policy to be put in place to support the development and growth of agroecological farming practices in Haiti to improve food production, food security and incomes in rural communities, reduce reliance on imported foods, increase climate resilience, speed agricultural sector development, and improve the livelihoods of Haitians at local and national levels.

Implementing an agroecological transition in Haiti is possible but will require innovative policy and an enabling environment that prioritizes the agency of farmers' and their organizations, backed by economic and social support from the Haitian government.

- **It is recommended that decision makers** develop targeted agricultural policies and incentives to support agroecological development and transition. This can and should happen through multiple channels, for example:
- **Support large scale investments to strengthen the agency and capacity of farmer organisations and NGO's** for decentralized and participatory agroecological innovation and research, linked to farmer-to-farmer extension of effective practices. In doing so, emphasize the inclusion of women and young people in rural areas.
- **Provide support and targeted agricultural subsidies for community-led management of inputs and assets that incentivize and enable agroecological production** e.g., community savings and credit cooperatives; seed banks, tree nurseries, grain reserves; composting facilities; appropriate technologies such as machinery and labour saving tools for soil conservation barriers, terraces, and other practices; water harvesting, storage and small scale irrigation; rotating livestock schemes; live and constructed fencing; post-harvest storage and valued added processing; and local market access and linkages.
- Implement systems to **measure progress** and **define criteria** to select and support agroecological projects which have transformative potential.
- **Enable markets for ecosystem services** and **payment for environmental services**. Examples for supporting this from other countries include fiscal transfers from central to local governments based on ecological criteria to invest in landscape restoration.
- **Improve land tenure for farmers** so they can reap the rewards from soil and water conversation, farm diversification and agroforestry, and other on-farm investments.
- **Help unlock patient capital at reasonable interest rates, through blended finance solutions** that can mobilise commercial capital.
- **Develop economic incentives and marketing strategies to promote agroecological practices,** such as prioritising procurement of agroecologically produced food from smallholder farmers for public institutions such as school, hospitals, etc.
- **Critically review international and national trade policies** to help bolster economic growth and sustainable food production and food security in Haiti.

Finally, the adoption and scaling of agroecological production by peasant associations will require significant support and public-private-NGO partnerships at both national and local levels. Specific reforms and economic instruments of interest to scaling agroecology in Haiti should be evaluated, designed, and implemented in the context of the overall fiscal, economic, political, and administrative systems in Haiti.

6. Conclusion

The analysis conducted found ample evidence to support the scaling-up of agroecological model farming in the Northern plateau of Haiti. This would have major implications for the income of farmers and rural economies. Whilst model farmers currently apply agroecological practices on a third of their land, the majority would like to scale these practices. Should they have the resources to do so, and convert the remaining two thirds to model farms, this would result in approximately 60,800 gourdes of additional income per house-

hold per year.[10] This would equate to an additional US $553[11] of income, above those net income increases already documented in this study. If this approach and associated benefits were further extrapolated to Haiti's entire peasant farmer population, this would result in a significant economic infusion into rural economies, on top of the individual level, ecosystem, and climate resiliency benefits. For this to occur, action is needed.

New partnerships, mobilisation of resources, research support and significant investment in the scaling of agroecological farming practices is key in order for the Haitian government to address the current food and poverty crisis. Coupled with this, NGOs such as PDL are serving critical complementary roles, by strengthening peasant organizations from the bottom-up to create democratic participation in spreading agroecological farming and sustainable livelihoods. In a political context, this contributes to the creation of decentralized agricultural innovation, extension and development, and the regeneration of degraded land and rural livelihoods.

Momentum is sustained and gained, by involving the local organisations and stakeholders in the planning, implementation, and monitoring of the processes and practices. The study presented here, will likewise be shared within the municipalities of Saint Raphael, Mombun-crochu and Pignon, to further stimulate social learning, co-innovation, and co-creation of solutions to help the transition toward sustainable food systems, improved health, and well-being in the Northern Plateau of Haiti.

10 Ignoring any potential general equilibrium effects.
11 Where 1 gourde is US$0.0091 in May 2022, to account for depreciation of the gourde against the US$.

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Acknowledgements:
We are grateful for the Haitian enumerators who carried out the surveys, for the peasant families who agreed to be participate in surveys and focus groups, for the staff of PDL and Groundswell International, and for the financial support of the Casey & Family Foundation and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the German Federal Ministry for Economic Cooperation and Development.

Co-published by:

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