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Nurturing the Earth:

The Role of Soil Protection and Rehabilitation for Food Security

Collection of findings from the Global Programme
"Soil Protection and Rehabilitation for Food Security" (ProSoil)

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Bonn, March 2025

Content

List of Abbreviations

BMZ	Federal Ministry for Economic Cooperation and Development
CAET	Characterisation of Agroecological Transition
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement French Agricultural Research Centre for International Development
CP	Country Package
DeSIRA	EU initiative Development Smart Innovation through Research in Agriculture
EU	European Union
FAO	Food and Agricultural Organization
FIES	Food Insecurity Experience Scale
FNS	Food and Nutrition Security
FS	Food Security
GHG	Greenhouse gas emissions
GSI	Gini-Simpson Index
HLPE	High Level Panel of Experts on Food Security and Nutrition
IDDS	Individual Dietary Diversity Score
ISFM	Integrated Soil Fertility Management
M&E	Monitoring and Evaluation
MAP	Measuring Agroecology and its Performance
MDD	Minimum Dietary Diversity
NS	Nutrition Security
ProSilience	EU-co-funded action within ProSoil to enhance soils and agroecology for resilient agri-food systems in Sub-Saharan Africa
ProSoil	Global Programme “Soil Protection and Rehabilitation for Food Security”
SEWOH	Former special initiative “ONE World – No Hunger”); replaced by special initiative “Transformation of Agricultural and Food Systems”
SPR	Soil protection and rehabilitation
SU	Steering Unit
TAPE	Tool for Agroecological Performance Evaluation
ToR	Terms of Reference
WEAI	Women’s Empowerment in Agriculture Index
A-WEAI	Abbreviated WEAI

1 Context and Objective

Through its special initiative "Transformation of Agricultural and Food Systems", which replaces the previous special initiative "ONEWORLD – No Hunger", the German Federal Ministry for Economic Cooperation and Development (BMZ) is making a significant global contribution to the eradication of hunger and malnutrition among rural populations in developing countries. Among others, field of action five of the special initiative calls for the protection and rehabilitation of soil used for agricultural purposes. As part of the special initiative, these key factors are met within the Global Programme "Soil Protection and Rehabilitation for Food Security" (ProSoil), which is commissioned by BMZ and co-funded by the European Union (EU) and the Gates Foundation.

The objective of the Global Programme is to implement agroecological approaches for sustainable, climate-smart soil protection and restoration on a large scale in selected partner countries. ProSoil's measures cover the following partner countries (with month and year in which ProSoil activities began in brackets): Benin (01/2015), Burkina Faso (04/2015), Ethiopia (lowlands and high-lands, both started in 02/2015), India (04/2015), Kenya (04/2015), Madagascar (01/2018), and Tunisia (09/2019). ProSoil's strategic aim is to achieve the most inclusive impact possible by adopting proven and upgraded technologies for soil protection and the rehabilitation of degraded soil, including short-term solutions. It will also improve the regulatory and socioeconomic framework. In addition, it will help partners leverage lessons learned, evaluate them in terms of policy, and engage them in national and international dialogue.

Since June 2021, ProSoil has also been co-funded by the European Union's (EU) DeSIRA (Development of Smart Innovations Through Research in Agriculture) initiative), called "ProSilience – Enhancing soils and agroecology for resilient agri-food systems in Sub-Saharan Africa". Its specific objective is to enhance the agroecological transition towards sustainable agri-food systems in selected partner countries. The co-funding focuses on the following four ProSoil country packages (CP): Benin, Ethiopia/ISFM+ (highlands), Kenya and Madagascar. As ProSilience is fully embedded in ProSoil, it builds upon already implemented activities and achieved results.

In the Global Programme's theory of change, the outcome of improving the food security situation is located at the impact level (see chapter 2.2). In terms of the dimensions of Food and Nutrition Security (FNS), ProSoil covers some aspects of the dimensions of availability, access, stability, agency and sustainability (see chapter 2.3 a). The theory of change suggests that the outputs and outcomes of ProSoil can have an indirect impact on each of the sub-dimensions of the areas of stability, food availability, food access and the political and economic framework. The other areas that are necessary to achieve FNS, such as dietary behaviour change, are not addressed by the Global Programme, or only to a very limited extent.

As food security is at the impact level in the theory of change, there are no indicators or direct measurements of this impact. So far, the data collected by ProSoil provides limited information. Further studies were therefore carried out (see chapter 3) and analysed in this study. The results are being presented in chapter 4.

The **main objective** of this study is to analyse the existing studies and sources in order to compile and prepare evidence on the link between ProSoil's actions on food security in a communicative way (key messages) for communication purposes and for accountability of the commissioning party and co-funders. Accordingly, conclusions and key messages are presented in chapter 5. The original

option to conduct one or two additional qualitative studies in Kenya and/or Madagascar to get more evidence or complementary results on specific FNS issues has not been realised as TAPE has provided sufficient quantitative data for both countries and in Madagascar even further studies with quantitative and qualitative data collection were carried out.

2 Theoretical Background

In addition to the results model mentioned above, various theories discuss which aspects and dimensions influence FNS. One possible and widely used definition is the four dimensions of food security developed by the Food and Agricultural Organization (FAO) (access, availability, stability and utilisation), which have been complemented two further dimensions (agency and sustainability) by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE).

2.1 Dimensions of Food and Nutrition Security

Before explaining the dimensions of FNS, it is important to establish a common understanding of Food Security (FS) and Nutrition Security (NS). While some organisations already include the nutritional aspect in FS, this report will make a distinction and will refer to FS as a status where households have reliable access to and enough food for all household members. The focus is on the quantitative dimension, calorie intake. Meanwhile, NS addresses the qualitative dimension: It focuses on consistent access to safe, affordable, and healthy food that provides essential nutrients for optimal health and well-being.

A holistic approach of FNS has been developed by HLPE, although HLPE is referring to this using only the term FS:

Figure 1: The Six Dimensions of Food and Nutrition Security

Source: HLPE, 2020

THE SIX DIMENSIONS OF FOOD SECURITY

Availability	Having a quantity and quality of food sufficient to satisfy the dietary needs of individuals, free from adverse substances and acceptable within a given culture, supplied through domestic production or imports.
Access (economic, social and physical)	Having personal or household financial means to acquire food for an adequate diet at a level to ensure that satisfaction of other basic needs are not threatened or compromised; and that adequate food is accessible to everyone, including vulnerable individuals and groups.
Utilisation	Having an adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met.
Stability	Having the ability to ensure food security in the event of sudden shocks (e.g. an economic, health, conflict or climatic crisis) or cyclical events (e.g. seasonal food insecurity).
Agency	Individuals or groups having the capacity to act independently to make choices about what they eat, the foods they produce, how that food is produced, processed, and distributed, and to engage in policy processes that shape food systems. The protection of agency requires socio-political systems that uphold governance structures that enable the achievement of FSN for all.
Sustainability	Food system practices that contribute to long-term regeneration of natural, social and economic systems, ensuring the food needs of the present generations are met without compromising the food needs of future generations.

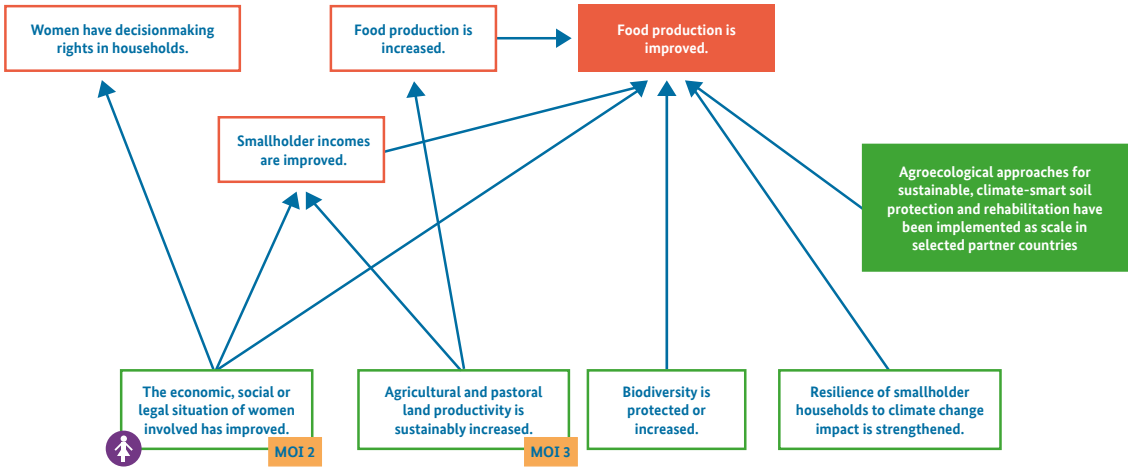
Source: HLPE, 2020

ProSoil's activities address five of the six dimensions to varying degrees: Availability, Access, Stability, Promotion and Sustainability. Only the aspect of utilisation is not included, as this dimension is very complex and already target of the specific Global Programme "Food and Nutrition Security, Enhanced Resilience", which was one of the first Global Programmes under the special initiative "ONEWORLD – No Hunger".

2.2 ProSoil – Results Model

As the purpose of the study is to analyse the link between ProSoil and FNS, this study only looks at the part of the results model that shows a link to FNS.

Figure 2: Results model (excerpt) of ProSoil on global level



Legend: MOI = module objective indicator

Source: ProSoil Results model (excerpt)

According to the logic of the results model, six results directly contribute to an improved food situation:

i. Agroecological approaches for sustainable, climate-smart soil protection and rehabilitation have been implemented at scale in selected partner countries (will be referred to as Result 1).

ii. Resilience of smallholder households to climate change impact is strengthened (will be referred to as Result 2).

iii. Biodiversity is protected and increased (will be referred to as Result 3).

iv. The economic, social or legal situation of women involved has improved (will be referred to as Result 4)

v. Smallholder incomes are improved (will be referred to as Result 5)

vi. Food production is increased (will be referred to as Result 6)

Overall, the topic is quite complex and there are many interlinkages between the different activities promoted by ProSoil. Only a few activities and their impacts will be presented in order to show that there is – in general – a link between the different results of the CP and FNS. A relevant aspect is the promotion of a higher crop diversity, especially through the introduction of protein-rich legumes. This not only contributes to higher soil fertility and thus increased crop production and income, but also to a more diversified diet with many nutritional benefits (Nekesa et al., 2024). The positive effects on soil fertility, carbon storage and water retention capacity are further enhanced by the addition of compost and/or the introduction of agroforestry. These measures contribute to the dimensions of availability and access as well as stability and sustainability.

The Global Programme has a special focus on women and their rights. The assumption is, that empowering women will have an impact on the FNS of the whole community, since women, especially in rural areas, are responsible for caring for children and feeding the whole family.

However, the ProSoil approach with its planned activities reaches its limits when it comes to FNS as it does not cover all six dimensions of FNS. For example, the use of dimension includes the aspect of education and knowledge as well as hygiene and access to clean water. All these aspects are beyond the scope of ProSoil and are therefore not analysed.

2.3 Concept of Agroecology

Agroecology is a holistic approach with many interpretations. The FAO defines agroecology as "an integrated approach that applies both ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimise the interactions between plants, animals, humans and the environment, taking into account the social aspects that need to be addressed for a sustainable and equitable food system" (for more information on the 10 elements, see the FAO website[1]). From the perspective of the HLPE, it is an even broader concept based on 13 principles for sustainable food systems (for further information, see HLPE Report 14, 2019[2]).

3 Sources of Information

It is important to understand each CP with its logic and activities. Therefore, the reports and data collected by ProSoil are an important source of information. In particular, the indicator of module objective 3, yield increase, has been analysed, as well as information on crop diversification. Data is not available for all CPs in every year due to extreme weather events (e.g. drought or pests) or security situations. As food security itself is at the impact level in the results model, there are no indicators or direct measurements of this impact carried out by the CPs, so other sources are needed (see Table 1).

[1] *10 elements | Agroecology Knowledge Hub | Food and Agriculture Organization of the United Nations.*

[2] *HLPE Report #14 – Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition.*

Table 1: Overview of main sources of information

	Benin	Burkina Faso	Ethiopia/ ISFM+	Ethiopia (Lowland)	India	Kenya	Madagascar	Tunisia
M&E-System	x	x	x	x	x	x	x	x
Country Studies	x				x		x	
TAPE	x		x			x		
Gender studies	used to cross check plausibility only							

Source: Own compilation

In addition, as part of the Global Programme's **M&E system**, each CP carried out studies to collect data for the gender indicator at the outcome level, focusing on the aspect of improving the situation of women. The semi-standardised questionnaire includes optional questions on the number of meals consumed as well as some qualitative information on what women decide to do with the additional yields and/or income. As a result, additional information is available for some CPs. As the questionnaires were adapted for the gender studies, the sample size is relatively small and often not all questions were answered, the results are comparable to a limited extent and often no evidence is provided. Therefore, the results have only been used to cross check results of other studies.

In addition, further **studies on the impact of ProSoil on food and nutrition security** were carried out in three CPs (India, Benin and Madagascar). In Benin, the CARI-Approach (a method of analysing primary data from a single household survey to classify them according to their level of FS) was used; in India, Minimum Dietary Diversity (MDD) is provided on household level. For both countries, the results are difficult to interpret: In Benin, the results are inconsistent and sometimes contradictory due to a relatively small sample size. With regards to crop diversification, results are strange, as the project is promoting diversification, but results show the opposite. In India, households that had benefited from nutrition interventions, were selected for the study. Accordingly, a change in dietary behaviour is intended and can be expected as a result of project activities. This finding is supported by the study data, but the study cannot conclude whether a soil improvement programme focusing on soil activities alone can contribute to improved nutrition. In Madagascar, both quantitative and qualitative data were collected, which supports the understanding and interpretation of the data collected.

In order to gain a better understanding of the impact of ProSoil on FNS, it is necessary to synthesise existing evidence and measure food security in the programme areas through surveys using comparable methodologies in order to arrive at precise key messages on this issue. For this reason, food security-related data that has been collected under ProSilience in Benin, Ethiopia/ISFM+, Kenya and Madagascar using the **Tool for Agroecological**

Performance Evaluation (TAPE) were analysed. World Agroforestry (ICRAF), as part of its ***Measuring Agroecology and its Performance (MAP) project*** funded by ProSilience, applied the standardised FAO methodology to 839 households/smallholder farms in the four Sub-Saharan partner countries. These data collections provided evidence on the agroecological levels of transition and the multidimensional performance of agroecology at farm and territorial levels, and include indicators for FS, such as the Food Insecurity Experience Scale (FIES), and for food security such as the Individual Dietary Diversity Score (IDDS). TAPE's standardised methodology and appropriate sample size, with data collected in the context of agroecology and FNS, seems most appropriate for this study. Unfortunately, the TAPE data for Madagascar could not be used for the purposes of this study, as it turned out that allocations to the project beneficiaries and comparison group were incorrect. Subsequent correction of the allocations means that the control group is too small to identify statistically clear differences between the two groups. Furthermore, a country study carried out by CIRAD (*Centre de coopération internationale en recherche agronomique pour le développement*) on socio-economic effects of ProSoil's activities on differences between the two groups (beneficiaries and non-beneficiaries) in Madagascar comes to the conclusion that other factors play a major role in the question of the adoption of agroecological measures in practice, in particular economic resources and land size, but also the availability of labour or sufficient organic material which should be considered by introduction and/or upscaling agroecological measures.

There are other limitations to the data collected: First, there is insufficient statistical power in some respects due to high standard deviations, and second, there is insufficient data to draw conclusions from the country contexts at the global level.

4 Results

A lot of data has been collected over the course of the Global Programme. Yet measuring soil protection and rehabilitation is doomed to be a difficult task as there are multiple dimensions and factors influencing soil health. The number and type of measures promoted by ProSoil vary widely between its CPs and must vary, as they need to be adapted to the local context. However, different measures naturally have different effects; some have a very rapid impact, such as the use of (organic) fertiliser or improved seeds, or investments to increase water availability, while other measures aiming at an improved soil structure, such as no-till farming, only show their full potential after a longer period of time, measured in decades rather than years.

4.1 Increase in Yields

Yield increase is an indicator to measure module objective 3. Data is therefore provided by the respective M&E systems of all CPs and is accordingly available for most countries and years. Exceptions are Ethiopia (Lowland), Madagascar and Tunisia for different reasons (see footnotes).

Table 2: Yield increase (in %), beneficiaries in comparison to control group (2019-2023)

	Benin	Burkina Faso	Ethiopia/ ISFM+	Ethiopia (Lowland)	India	Kenya	Madagascar	Tunisia
2019	49,0%	31,0%	54,0%	261%[3]	16,0%	32,0%	[4]	[5]
2020	59,0%	31,0%	68,0%	[6]	17,0%	37,5%	56,5%	[7]
2021	53,0%	32,0%	76,0%	[8]	16,0%	38,0%	52,0%	10,0%
2022	58,0%	41,0%	62,0%	[9]	22,0%	34,5%	33,0%	13,0%
2023	58,0%	23,0%	45,0%	[10]	24,0%	38,0%	[11]	[12]

Source: Own compilation based on progress reports of CP for the years 2019 - 2023

Monitoring data taken by the CP show high yield increases, with most countries and most years showing yield increases of more than 50% compared to the control group. India and Tunisia (in the years for which data is available) show moderate yield increases between 10% and 24%.

Looking at the TAPE data, yield increases over the comparison group are confirmed for most crops, but these differences are not significant due to the very high standard deviation. This suggests that other factors play a more significant role in determining yield levels. An exception is maize cultivation in Kenya, where there is significant evidence that ProSoil beneficiaries harvest more than twice as much as the comparison group. This study refers to the progress reports at this stage as these provide data on a year-by-year basis, making them a more robust basis than TAPE with a single year's observation. Furthermore, a positive impact of agroecological measures on yields is confirmed by different international studies examining the impact of the introduction of agroecological measures in different regions of the world (Faure et al., 2024; Rasmussen et al., 2024).

[3] *Data only representative to a limited extent due to the pilot character*
[4] *No data yet*
[5] *First year of implementation, no data collection*
[6] *No data collection due to a plague of locusts*
[7] *No data yet*
[8] *No data collection due to the expansion of the Tigray conflict into the target region*
[9] *No data accessible*
[10] *No cultivation outside of recultivated area*
[11] *No data available due to cyclone damage*
[12] *No data available due to drought*

4.2 Increase in Income

According to the result model, increased yields should lead to an increase in income. In reality, the relations are much more complex. Total income comes from different sources, and the application of agroecological measures is often more labour intensive. How to measure income? How to consider the different amount of labour or other inputs used in a different agricultural system? Moreover, measuring income in a rural context is a major challenge. TAPE provides different types of data to measure income. To reduce the complexity, the author chose to use perceptions of income development. Participants of the study were asked whether they think their income has changed over the past three years. They could choose in a range of 1 to 5 whether they earn much more (=1) to much less (=5). Results are shown in table 3. More detailed information is provided by another in-depth-study, carried out by HFFA Research (GIZ, 2024). Within this study, different agroecological measures were grouped and yields and income per group of activities were analysed.

Table 3: Income development over the last three years (Perception)

	Improvement of Income (last 3 years)			
	ProSoil beneficiaries	**Comparison group**	**ProSoil beneficiaries**	**Comparison group**
	Average		**improved**	
Benin	2,5	3,3	62%	14%
Ethiopia/ISFM+	2,5	3,3	68%	31%
Kenya	1,9	3,0	94%	33%

Legend: 1 = much more income, 2 = more income, 3 = Same income, 4 = less income, 5 = much less income

Source: ICRAF, 2024, own calculations

The first two columns show the average perception of income development over the last three years comparing ProSoil beneficiaries and the control group. The data impressively show that in all three CPs, ProSoil participants feel a significant increase in income (p=0,05), while the income in the control groups has remained more or less the same and even tended to be lower. Most beneficiaries surveyed (62% in Benin, 68% in Ethiopia and 94% in Kenya) perceive an improvement in their income situation, while this proportion is relatively low in the control group (between 14% and 33%).

In general, TAPE data also confirm a highly significant positive correlation between agroecological transition (CAET scores) and both farm productivity and household net income. The above-mentioned study carried out by HFFA Research GmbH

provides a more differentiated analysis of the effects of ProSoil's agroecological measures on income. It distinguishes between different agroecological packages of measures: Unsurprisingly, measures that are more or less directly aimed at increasing soil fertility (Integrated Soil Fertility Management (ISFM)), such as the use of compost, manure or cover crops, make an immediate contribution to increasing yields and income, even taking into account the usually higher labour input (GIZ, 2024). Also, soil and water conservation measures are not only viable from an environmental perspective, but also from the economic perspective of an individual farmer. Especially in arid and semi-arid areas, investments in the conservation of soil and water pay off very quickly. In general, organic land management practices also result in higher net financial benefits than conventional practices due to higher market prices and lower health costs. However, the measures applied must always be adapted to the local context. For example, the introduction of agroforestry usually leads to increase yields and system diversification but is not always financially viable for small-holder farmers due to high initial investment costs and the need for trees to reach a certain height.

4.3 Resilience

In theory, implementing agroecological measures should improve resilience . The concept of resilience is very broad: Following the widely used definition of United Nations Office of Disaster Risk Reduction, resilience is "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (FAO, IFAD and WFP, 2015). For example, the use of compost and mulching increases the organic matter in soil, which in turn increases the soil's ability to retain water, resulting in more stable yields, especially during dry periods. The integration of trees (agroforestry) and the introduction of drought-resistant species and varieties, such as sorghum, is another measure to secure yields in the event of droughts. The cultivation of legumes reduces external dependence on nitrogen fertilisers and improves soil structure. At the same time, it provides a valuable source of protein for humans and/or animals. In this sense, many agroecological measures have a resilience-enhancing effect. Ultimately, however, the impact in terms of increasing resilience depends on what is put into practice in which context.

This is one of the reasons why the impact on resilience is difficult to measure. TAPE provides data on income stability, which is used here as an indicator for a more resilient production system. Additionally, the author refers to the aspect of crop diversification, as a more diverse cropping system should demonstrate increased resilience as well.

4.3.1 Stability of Income

The indicator is also a perception indicator. Households were asked whether their income had become more stable or not over the last three years. Results are shown in table 4.

Table 4: Stability of Income (Perception)

	Stability of Income			
	ProSoil beneficiaries	Comparison group	ProSoil beneficiaries	Comparison group
	Average		stable or improved	
Benin	2,5	1,7	60%	23%
Ethiopia/ISFM+	2,6	2,2	58%	36%
Kenya	3,2	1,8	82%	22%

Legend:
0 - Income is decreasing year after year, production is highly variable despite constant level of input and there is no capacity to recover after shocks/perturbations.
1 - Income is on decreasing trend, production is variable from year to year (with constant inputs) and there is little capacity to recover after shocks/perturbations.
2 - Income is overall stable, but production is variable from year to year (with constant inputs). Income and production mostly recover after shocks/perturbations.
3 - Income is stable and production varies little from year to year (with constant inputs). Income and production mostly recover after shocks/perturbations.
4 - Income and production are stable and increasing over time. They fully and quickly recover after shocks/perturbations.

Source: ICRAF, 2024, own compilation

The first two columns show the average results for the question of the extent to which income and production have remained stable in the last three years. In all the three countries Benin, Ethiopia and Kenya, ProSoil's beneficiaries show a much higher and statistically significant (with p=0,05) stability of income than the control group: Between 58% and 82% of the beneficiaries perceive a stable income, whereas in the control group only between 22% and 36% of households do so.

4.3.2 Crop Diversification

Other indications for resilience are the number of crops grown or the Gini-Simpson Index (GSI). The GSI is another way of expressing diversity, measuring the probability that two randomly selected crops belong to different species. The GSI score varies between 0% and 100%. A high score indicates high diversity, and a low score indicates low diversity. When the diversity index is zero, only one species can be found (i.e., no diversity). As the number of different species increases and the distribution of species becomes more even, the diversity index increases and approaches 100%.

Table 5: Crop diversification

	# Crops grown		GSI Crops	
	ProSoil beneficiaries	Comparison group	ProSoil beneficiaries	Comparison group
	Average		stable or improved	
Benin	3,2	2,2	83%	64%
Ethiopia/ISFM+	5,6	4,2	97%	92%
Kenya	4,9	3,9	83%	65%

Source: ICRAF, 2024, own compilation

All three CPs show a significant increase (p=0,05) in the number of grown crops. It can thus be concluded that ProSoil is successfully promoting more diverse cropping systems. The GSI shows that the distribution of grown crops is more or less the same in Ethiopia and quite different in Benin and Kenya.

4.4 Healthy Diet and Knowledge

Awareness and knowledge about healthy diets play an important role in improving the quality of diets and although this is not a focus of ProSoil's activities, the aspect will be examined. According to the HLPE dimensions (see chapter 2.1), awareness and knowledge are key factors to improve diets quality and thus nutrition security.

Unfortunately, there is no data focussing on awareness and knowledge. However, the TAPE study collected data on two aspects: improved diets and knowledge, which were analysed instead.

Table 6: Balanced diet and knowledge

	Balanced Diet and Knowledge			
	ProSoil beneficiaries	Comparison group	ProSoil beneficiaries	Comparison group
	Average		2,5 - 4	
Benin	2,2	1,9	52%	27%
Ethiopia/ISFM+	2,9	2,4	82%	58%
Kenya	2,7	1,8	71%	25%

Legend:
0 = Diet does not meet nutritional needs and there is a lack of awareness of good nutritional practices
1 = Periodic insufficiencies for diet to meet nutritional needs and/or diet is based on a limited number of food groups. Lack of awareness of good nutritional practices.
2 = Overall food security over time, but insufficient diversity in food groups. Good nutritional practices are known but not always enforced.
3 = Food is sufficient and diverse. Good nutritional practices are known but not always enforced.
4 = Healthy, nutritious, diversified diet. Good nutritional practices are well known and enforced.
Possible answers are: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4

Source: ICRAF, 2024, own compilation

The first two columns indicate the respondent's perception of the quality of their diet and their knowledge about healthy diets. The higher the number the healthier the diet and the better the knowledge. There is a significant change in diet and knowledge in Benin, Ethiopia, and Kenya. In these three countries the quality of diet and level of knowledge is higher than in the control group, even in Ethiopia, where the level is already quite high. The latter two columns show the percentage of respondents answering 2.5 or higher, what means that they perceive at least an overall food security and are aware of good nutritional practices, although not always enforced. This is perceived by the majority of the beneficiary group in Benin (52%), Ethiopia (82%) and Kenya (71%).

The result is remarkable, as the CPs did not carry out any activities to improve diets or to increase knowledge and awareness of the importance of healthy diets. In general, awareness-raising campaigns are seen as necessary to influence the aspect of improved nutrition. On the other hand, there might be a link between knowledge, diet quality and women's empowerment. As women's empowerment is another ProSoil objective, it could explain at least partly a positive development in the quality of nutrition. In addition, it cannot be completely excluded that other projects in the regions of the programme have worked on this.

4.5 Women Empowerment

Another element difficult to measure is women's empowerment. The Women's Empowerment in Agriculture Index (WEAI) is a complex tool, created in 2012 in collaboration between various international organisations, that shows women's empowerment, agency, and inclusion in the agricultural sector. It measures the roles and extent of women's involvement in the agricultural sector in five domains of empowerment: (1) decisions about agricultural production, (2) access to and decision-making power over productive resources, (3) control over use of income, (4) leadership in the community, and (5) time use. It also measures empowerment of women relative to men within their households. Two indicators are constructed for each domain, for a total of 10 indicators. Within TAPE, the Abbreviated version of the Women's Empowerment in Agriculture Index (A-WEAI) is used, which retains its five domains of empowerment, but reduces the ten indicators to six. Each of the five domains is weighted equally at 20%. The maximum achievable score is 100, which represents the highest form of empowerment. For more information, see the IFPRI website[13].

Table 7: Women empowerment, measured by the A-WEIA

	A-WEIA	
	ProSoil beneficiaries	Comparison group
	Average	
Benin	71,9	55,0
Ethiopia/ISFM+	74,3	72,8
Kenya	77,1	72,0

Source: ICRAF, 2024, own compilation

The results show significant improvements in Benin. The two other countries, Ethiopia and Kenya show improvements, but these are not statistically significant (p=0,05). It is interesting to note that there is a positive correlation between this indicator and diet quality, as measured by the IDDS (see chapter 4.7). The picture is slightly different if not all aspects of women empowerment get considered, but only decision rights.

[13] *Women's Empowerment in Agriculture Index (WEAI) | IFPRI*

Table 8: Women's decision rights

	Decision rights of Women			
	ProSoil beneficiaries	Comparison group	ProSoil beneficiaries	Comparison group
	Average		2,5 - 4	
Benin	2,5	1,7	61%	10%
Ethiopia/ISFM+	3,0	2,7	83%	67%
Kenya	2,7	1,8	70%	28%

Legend:
0 - Women do not normally have a voice in decision making, not in the household nor in the community. No organisation for women empowerment exists.
1 - Women may have a voice in their household, but not in the community. And/or one form of women association exists but is not fully functional.
2 - Women can influence decision making, both at household and community level, but are not decision makers. They don't have access to resources. And/or some forms of women associations exist but are not fully functional.
3 - Women take full part in decision making processes, but still don't have full access to resources. And/or women organisations exist and are used.
4 - Women are completely empowered in terms of decision making and access to resources. And/or women organisations exist, are functional and operational.
Possible answers: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4.

Source: ICRAF, 2024, own compilation

The table demonstrates significant differences in the decision-making rights of women participating in ProSoil activities compared to the control group in the three CP Benin, Ethiopia and Kenya. In the CP Ethiopia there is a small difference (but already at a comparatively high level) and in Benin and Kenya there are larger differences.

4.6 Food Insecurity

As mentioned above, in order to measure food security, the FIES (Food Insecurity Experience Scale) indicator was used. This indicator is an experience-based measure of household or individual food insecurity. The survey consists of eight questions regarding people's access to adequate food in the last twelve months. The indicator focuses on quantitative aspects and does not measure the quality of diets. The higher the percentage, the more food secure people are. 0% means completely food insecure and 100% means not food insecure.

Table 9: The Food Insecurity Experience Scale

	FIES	
	ProSoil beneficiaries	**Comparison group**
Benin	73,5%	54,7%
Ethiopia/ISFM+	91,9%	85,0%
Kenya	56,9%	51,6%

Source: ICRAF, 2024, own compilation

There are significant differences between ProSoil and the control group in terms of experience of food insecurity in Benin, Ethiopia and Kenya (p=0.05). Strong improvements are seen in Benin, moderate improvements in Ethiopia and Kenya. It is also interesting to look at the level of food insecurity: The experience of food insecurity is highest in Kenya and lowest in Ethiopia.

4.7 Dietary Diversity

The Individual Dietary Diversity Score (IDDS) is an indicator which assesses the quality of a diet. It measures the number of pre-defined food groups consumed over the preceding 24 hours. The ten different food groups include: 1. grains, white roots and tubers, and plantains; 2. pulses (beans, peas and lentils); 3. nuts and seeds; 4. dairy; 5. meat, poultry, fish; 6. eggs; 7. dark green leafy vegetables; 8. other vitamin A-rich fruits and vegetables; 9. other vegetables; 10. other fruits.

Table 10 shows the number of food groups eaten on an individual level. It is recommended to consume at least 5 different food groups per day.

Table 10: Individual Dietary Diversity Score

	FIES	
	ProSoil beneficiaries	**Comparison group**
Benin	4,7	4,5
Ethiopia/ISFM+	4,5	3,6
Kenya	5,9	4,9

Source: ICRAF, 2024, own compilation

The results concerning the quality of diets differ widely between the different countries. In two countries, a significant difference between the ProSoil and control group can be seen: In Kenya, participants in ProSoil activities eat on average nearly one food group more than the control group. This is an extraordinary result, as this is the target of long-term FNS projects. In Ethiopia, there is still a difference of 0.9 food groups between control group and beneficiary households. In Benin, there is no significant difference in the quality of diet. As the project does not include activities to improve awareness and knowledge of healthy diets, improvements in this aspect cannot be expected.

4.8 Agroecological Transformation/Sustainability

One of the six above mentioned dimensions of FNS is the dimension of sustainability. As sustainability is an even broader concept than agroecology itself and there is no indicator for sustainability itself, this report uses the Characterisation of Agroecological Transition (CAET) instead. This index, measured as part of the TAPE data collection, covers the 10 elements of agroecology according to the definition given above by FAO (see also p. 9). All 10 elements are weighted equally, and on a scale of 0-100, 0 describes the beginning and 100 the end of the agroecological transition.

As agroecology is closely aligned with the principles of sustainability, the CAET index seems to be the most appropriate index to measure the degree of sustainability of food systems.

Table 11: Characterisation of Agroecological Transition (CAET) / Sustainability

	CAET	
	ProSoil beneficiaries	**Comparison group**
Benin	56,0	40,0
Ethiopia/ISFM+	69,2	56,0
Kenya	65,9	38,1

Source: ICRAF, 2024, own compilation

In the three countries Benin, Ethiopia and Kenya, the ProSoil group shows significantly higher average CAET values across all 10 elements of agroecology than the comparison group which means more sustainable food systems in all three countries. Kenya shows an exceptionally high improvement of 27 points, but Benin and Ethiopia also made progress with 16 and 13 points respectively. Nevertheless, in the ProSoil group, most households are still at an incipient stage of transition (CAET scores between 50 and 60) and only a few households are in an advanced transition stage (CAET scores above 75).

4.9 Summary of Results

Table 12: Results at a glance

			Resilience						
	Yields[14]	Income	Crop-diversity	Stability / Resilience	Diet and Knowledge	Women-Empower-ment	Food Insecurity (FIES)	Dietary Diversity (IDDS)	Sustain-ability
Benin	++	++	++	++	++	++	++	0	++
Ethiopia/ ISFM+	++	++	++	+	++	+	+	++	++
Kenya	++	++	++	++	++	++	+	++	++
Mada-gascar	++	0	+	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
India	+	+	+	+	+	n.d.	n.d.	+	n.d.
Burkina Faso	++	+	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Ethiopia/ Lowlands	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Tunisia	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Legend:
n.d. = no data
0 = no significant difference between ProSoil and control/comparison group
+ = significant, but moderate difference between ProSoil and control/comparison group
++ = significant and strong difference between ProSoil and control/comparison group

Source: ICRAF, 2024, Country Studies, ProSoil Progress Reports, own compilation

Table 12 simplifies the results of this chapter to make links between ProSoil's activities and FNS visible and are thus shown here in a simplified way. The present study focuses on the comparison of ProSoil and the control/comparison group, with regard to no, moderate and strong influence, or difference, respectively.

[14] *Results according to table 2 (Source: ProSoil progress reports)*

This is already a second simplification, as the situation differs between the countries and ProSoil's approach is always adapted to the local context. Furthermore, the complexity of FNS is extremely high and influenced by many factors. Generalisations should therefore be interpreted with caution and always be considered in the local context. Despite all these restrictions, some interesting observations can be made:

Where the programme achieves its primary targets of yield improvement and crop diversification, income increases and becomes more stable. Furthermore, an enhanced food security situation is being witnessed, characterised by an augmentation in available quantities. Yet no correlation with women's improved decision rights can be proven. However, a positive correlation effect can be assumed.

The quality of diets is more difficult to influence. It is grounded on awareness and knowledge. Activities to influence these elements were not part of ProSoil's strategy and thus have not been implemented. It could only be speculated as to why the CPs in Kenya and Ethiopia also contributed to improved and healthier diets. Probably, these two countries are an exception. At least this relation cannot be found in other CPs and thus it can be concluded that there is no automatism between ProSoil's activities focusing on soil health improvement and NS.

5 Conclusions

This study was conducted to contribute to the growing body of scientific evidence that soil protection and agroecology are contributing to FS and resilience. The ProSoil CPs target all elements and principles of agroecology, albeit with varying degrees of intensity. ProSoil places particular emphasis on activities to improve and maintain soil health, including gender aspects. Women play an important role in many ways, both in agricultural production and in caring for and feeding their families. All eight CPs follow a multi-level and multi-actor approach, addressing the micro, meso- and macro-levels with their different organisations. Furthermore, all CPs are in line with agroecological principles. Nevertheless, all the CPs find themselves in different situations with completely different frameworks in all relevant aspects (soil, environment, organisations, policy, etc.). Therefore, the activities of the CPs have to be adapted to the local conditions. At farm level, all CPs follow basic agroecological principles, promoting activities such as integrating legumes, increasing crop diversity, integrating agroforestry, producing and integrating organic fertiliser instead of chemical fertiliser and/or reducing dependence on pesticides.

For three CPs, Benin, Ethiopia/ISFM+, and Kenya, there is sufficient data to make statistically sound statements. For these countries, the correlations shown in the results model can be confirmed:

- ProSoil has contributed to crop diversification in cultivation. The number of crops grown has increased, especially legumes.
- The various soil health measures have led to an increase in yields and productivity, although the TAPE data show limited evidence due to the high standard deviation. Nevertheless, TAPE data also confirm increased incomes.
- The measures have contributed to increased resilience. Incomes are not only higher, but also more stable, allowing for a more secure food supply.

- ProSoil's gender-sensitive approach has contributed to the empowerment of women. They have more decision-making power, which enables them to provide more and better food for household members.
- The influence on dietary diversity varies. Knowledge and awareness play an important role in this context and the programme had not foreseen activities to influence this. Context obviously plays a major role here, and if the project finds a favourable environment, it can also contribute to greater dietary diversity, as it was the case in Kenya and Ethiopia.
- Furthermore, it can be assumed that increased production of more diverse crops will lead to an increase in available food, both at household level and on the (local) market. However, in the context of ProSoil, specific data were not collected on this issue and would need to be further investigated.
- There is statistically significant evidence of a contribution of ProSoil activities to a more sustainable agri-food system.
- Overall, the results suggest that soil protection and rehabilitation measures within an agroecological approach are highly effective in improving food security and nutrition in a short and long-term.

The following graphic refers to Figure 1 and briefly describes the evidence-based significance between ProSoil activities and the six dimensions of FNS.

Figure 3: Contribution of the Global Programme to the dimensions of Food Security

Source: HLPE, 2020, modified

There is evidence that ProSoil contributes to the four dimensions of availability (higher production), access (higher income), stability (more resilient production), and sustainability (higher CAET Index).

It can be assumed that there is also a contribution to the dimension of agency, but this dimension has not been measured.

6 Key Messages

Soil protection and rehabilitation (SPR) measures should be seen as a key element in the broader context of agroecology, and have the potential to contribute to the achievements of several Sustainable Development Goals (SDGs):

- **SPR and agroecology measures build resilience**
  SPR and agroecology measures contribute to increased resilience through different means: SPR measures include the introduction of more crops, especially legumes. Diversifying cropping systems reduces dependence on one or two crops. The integration of legumes also improves soil health and access to nitrogen, reducing dependence on external inputs. Increasing diversity and planting drought-tolerant crops and varieties ensures harvests despite harsh weather conditions. Mulching and more organic matter in the soil increase the water retention capacity, also contributing to better harvests when rainfall is low.

- **SPR and agroecology measures reduce pesticide use, resulting in healthier food and a healthier environment**
  SPR and agroecology measures contribute to reducing the use of pesticides in various ways: Crops grown in association with others exhibit lower susceptibility to pests and diseases, which reduces the need for pesticides Reducing the use of chemical fertiliser has a similar effect. In general, SPR measures aim to achieve a balance between beneficial insects and pests, resulting in less pesticide use. Soil coverage, an important SPR measure, greatly reduces weed pressure and consequently the need for herbicides.

- **More food and more income mean less poverty and less hunger**
  ProSoil provides strong evidence that successfully implemented soil health projects with their SPR measures lead to higher food production and incomes, and ultimately to more food consumption and less hunger. This also includes an increase in the amount of food available on local markets.

- **SPR and agroecology measures strengthen local economies**
  Agroecology strengthens a circular economy. Following the principles of reuse and recycling, the need for external inputs is reduced (compost instead of chemical fertilisers, bio inputs instead of agrochemicals, etc.). It also creates additional jobs and contributes to the development of the local economy.

- **Agroecology measures contribute to more empowerment of women**
  Agroecology measures, with their inclusive and gender-sensitive approach, lead to greater empowerment of women with more decision-making rights. As a result, women have influence over the crops that are grown, but also over the meals that are prepared and served to household members.

- **SPR measures contribute to healthier diets, if conditions are favourable**
  Several factors are needed to make diets more diverse and healthier. In addition to availability and access, awareness and knowledge are needed. If these are not addressed, an improvement in diets generally cannot be seen. However, can be learned from the CPs in Kenya and Ethiopia, ProSoil's SPR activities have also contributed to improved and healthier diets.

- **SPR measures contribute to more sustainable agri-food systems**
  With their holistic approach, the measures taken have contributed to an agroecological transition towards more sustainable agri-food systems.

7 Literature and Resources

Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., & Tittonell, P. (2020). The 10 Elements of Agroecology: enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystems and People*, 16(1), 230-247. Retrieved March 26, 2025, from *https://doi.org/10.1080/26395916.2020.1808705*

FAO. (2011). Guidelines for measuring household and individual dietary diversity. Rome, FAO. Retrieved March 26, 2025, from *https://openknowledge.fao.org/items/9bb3c3ce-66cf-4b00-b460-de29822bbd75.*

FAO, IFAD, & WFP. (2015). Strengthening resilience for food security and nutrition: A conceptual framework for collaboration and partnership among the Rome-based agencies. *https://www.fao.org/fileadmin/user_upload/emergencies/docs/RBA%20Conceptual%20Framework%20for%20Resilience_Final%2023April2015.pdf*.

FAO, IFAD, UNICEF, WFP, & WHO. (2023). *The state of food security and nutrition in the world 2023: Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. Rome, FAO. https://doi.org/10.4060/cc3017en*.

Faure, G., Geck, M., Paracchini, M. L., & Andrieu, N. (2024). What agroecology brings to food security and ecosystem services: A review of scientific evidence. Knowledge Brief 4. DeSIRA-LIFT. *https://agritrop.cirad.fr/608604/1/4%20Scientific%20Evidence%20for%20Agroecology.pdf*

Geck, M., Adeyemi, C., Adoyo, B., Alpuerto, J., Arinloye, A. A. D., Ateku, D., ... & Sinclair, F. (2024). Measuring Agroecology and its Performance (MAP): Key findings from applying the FAO Tool for Agroecology Performance Evaluation (TAPE) in Benin, Ethiopia, Kenya, and Madagascar in the con-text of the Global Programme Soil Protection and Rehabilitation for Food Security (ProSoil). Working Paper 8. Bogor and Nairobi: CIFOR-ICRAF: The Transformative Partnership Platform on Agroecology. *https://www.cifor-icraf.org/publications/pdf_files/WPapers/TPP-WP-8.pdf*.

GIZ. (2024). Economic benefits through agroecological soil practices: Evidence by ProSoil. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. *https://www.giz.de/en/downloads/giz2024-en-measuring-economic-benefits-of-agroecology.pdf*.

HLPE. (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition*. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. *https://openknowledge.fao.org/server/api/core/bitstreams/ff385e60-0693-40fe-9a6b-79bbef05202c/content*.

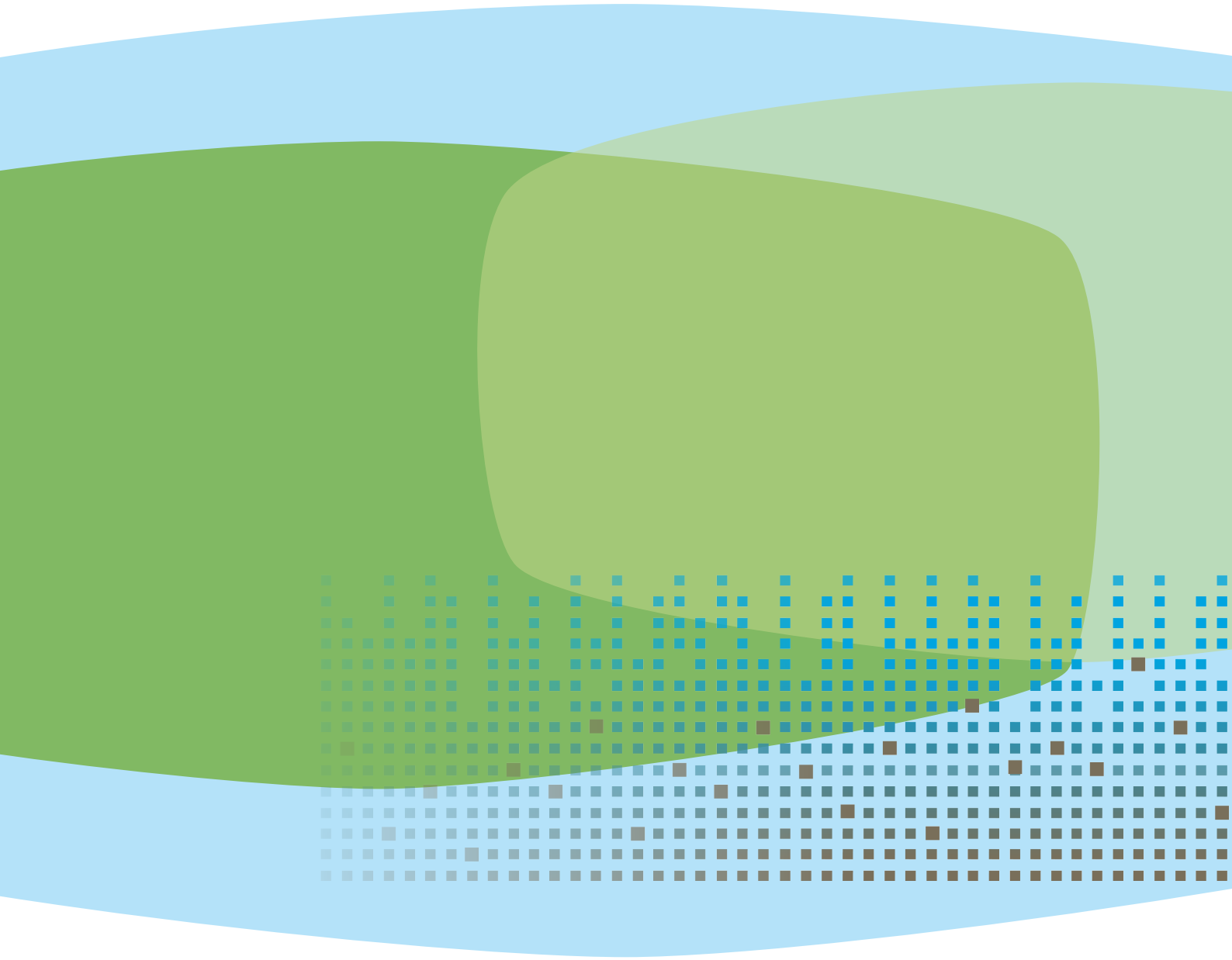
HLPE. (2020). *Food security and nutrition: building a global narrative towards 2030*. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. *https://openknowledge.fao.org/server/api/core/bitstreams/8357b6eb-8010-4254-814a-1493faaf4a93/content*

IFPRI. (n.d.). Women's Empowerment in Agriculture Index (WEAI). *International Food Policy Research Institute*. Retrieved March 26, 2025, from *https://www.ifpri.org/project/weai*.

Nekesa, T., Jaquet, S., Calles, T., Katsir, S., & Vollmann Tinoco, V. (2024). Fields of harmony: Pulses and sustainable land management. World Overview of Conservation Approaches and Technologies (WOCAT), Food and Agriculture Organization of the United Nations, & Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. *https://www.giz.de/de/downloads/giz2024-en-pulses-wocat.pdf*

Rasmussen, L. V., Grass, I., Mehrabi, Z., Smith, O. M., Bezner-Kerr, R., Blesh, J., ... & Kremen, C. (2024). Joint environmental and social benefits from diversified agriculture. Science, 384(6691), 87–93. Retrieved March 26, 2025, from *https://doi.org/10.1126/science.adj1914*

Saint Ville, A., Po, J. Y. T., Sen, A., Bui, A., & Melgar-Quiñonez, H. (2019). Food security and the Food Insecurity Experience Scale (FIES): Ensuring progress by 2030. Food security, 11, 483–491. Retrieved March 26, 2025, from *https://doi.org/10.1007/s12571-019-00936-9*



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