INITIATIVE ON
Nature-Positive Solutions

Nature-Positive Solutions Initiative survey report: Colombia

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1. Introduction

This study is part of the CGIAR Research Initiative on Nature-Positive Solutions for shifting agrifood systems to more resilient and sustainable pathways" (NATURE+), which aims to promote sustainable agricultural productivity through nature-positive solutions (NPS) by addressing three critical challenges:

Land Degradation: Industrial agriculture, while ensuring large-scale food production, has caused severe environmental harm, including 80% of global deforestation, threats to 86% of endangered species, significant biodiversity loss, and up to 37% of global greenhouse gas emissions. It also depletes water and soil health, reducing crop resilience and lowering farming incomes and nutrition outcomes. To mitigate these impacts, a shift toward resilient farming systems that support smallholder farmers and enhance agriculture's role as a positive force for nature is essential.

Limited Evidence and Knowledge to Support NPS: Awareness of the environmental costs of industrial agriculture has highlighted the need for sustainable farming practices, especially after the 2021 UN Food System Summit and the COVID-19 pandemic. NPS has significant potential, including creating 395 million jobs by 2030 (as per the 2020 World Economic Forum). However, gaps in evidence and tools for decision-making hinder scaling efforts. Research in biodiversity, soil health, and waste management is crucial to develop scalable innovations and support agricultural research for community development.

Lack of Business Models for Public-Private Partnerships: The private sector plays a vital role in scaling impact-oriented solutions, requiring supportive policies and incentives to encourage investments in sustainable pathways. Developing business models that combine scientific innovation with ecological, social, and livelihood benefits is necessary to foster collaboration and drive smallholder farming toward nature-positive practices.

This report summarizes the findings from the monitoring survey conducted in Colombia in February 2024. The survey uses the previous agricultural year (2023) as the reference period for data collection, with the objective of identifying potential areas for intervention, as well as monitoring and evaluating project outcomes. It provides a comprehensive overview of socio-economic conditions, agricultural systems, and food security, along with baseline data on practices such as waste management, soil and water conservation, resilient seed systems, and the commercialization of traditional products.

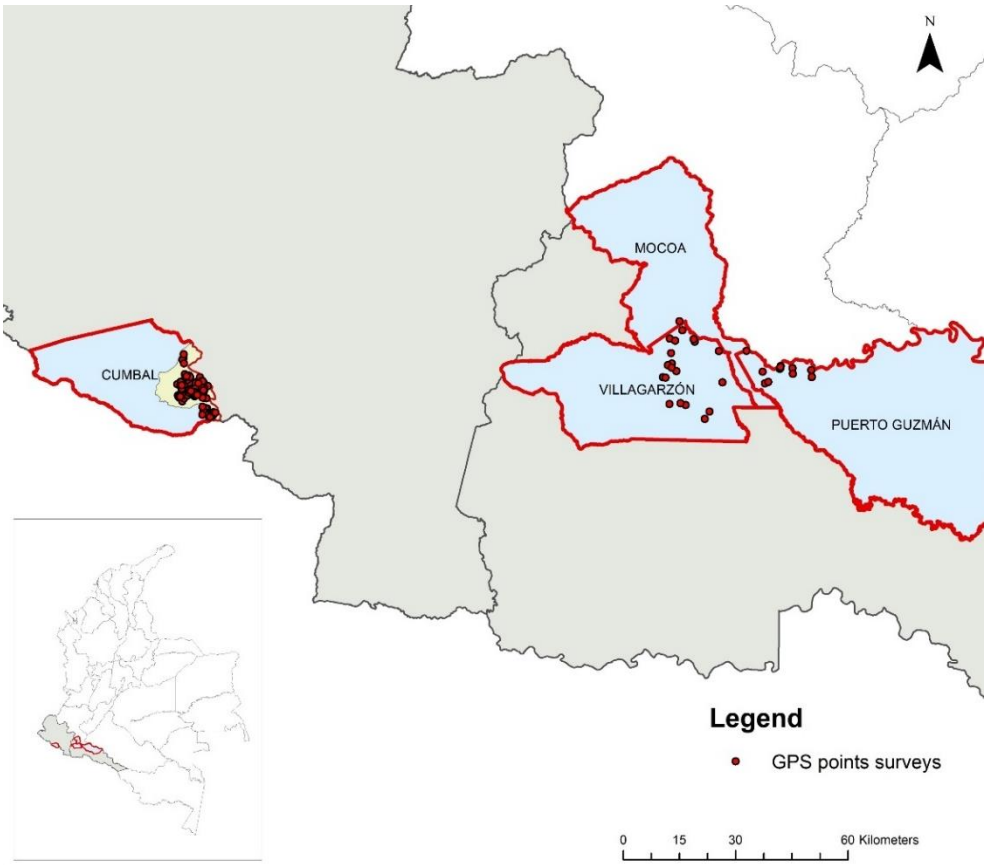
The report is structured as follows: Section 2 details the survey design and coverage, Sections 3 and 4 present analytical findings, and Section 5 offers conclusions and recommendations.

2. The Surveys

2.2 Coverage and study design

The Republic of Colombia is administratively divided into 32 departments, each of which is further divided into municipalities. These municipalities are subdivided into *corregimientos* and *veredas*. The survey was designed to cover areas relevant to the NATURE+ Initiative. The sites were selected based on two criteria: 1) Sites targeted by the NATURE+ work package (WP) for direct farmer interventions and 2) The site should integrate multiple work packages. Following the criteria data collection was concentrated in two broad agroecological zones: Nariño (specifically in the municipality of Cumbal) in the highlands and Putumayo (in the municipalities of Puerto Guzmán, Mocoa, and Villagarzón) in the lowlands. The survey was conducted in four municipalities across these departments from February 11 to February 26, 2024.

Figure 1. Base line survey coverage in Colombia



Source: Authors' elaboration

In Colombia, implementing a control group for evaluating interventions proved unfeasible due to the small population size and the highly site-specific nature of the activities. Moreover, the unique characteristics of Cumbal, an Indigenous reservation, further complicated the identification of comparable populations in nearby villages or regions. Despite these challenges, socioeconomic and agroecological characterization data for 259 potential beneficiaries from the departments of Nariño and Putumayo were successfully collected. While the dataset is smaller than anticipated, it offers valuable insights for ongoing monitoring efforts.

The NATURE+ initiative in Colombia identified and worked in targeted interventions to enhance sustainability, conserve biodiversity, and strengthen local socio-economic resilience. In Cumbal, interventions focused on

agrobiodiversity and ecosystem management under WP1 and WP2. These efforts included: socio-ecological characterization of agroecosystems, inventory of custodian farmers, inventory of agrobiodiversity conservation initiatives, agrobiodiversity education, study of market opportunities for local products, prioritization of value chains and exploration of articulation with public procurement and identification of actions to lift barriers to native seed system functioning.

In Putumayo, interventions under WP3 prioritized ecological restoration and sustainable land-use practices and agroforestry specially focused on cacao farmers. The work in this zone included: seed collection and distribution with local communities, establishing orchards of valuable tree species, and establishing plantations with native species as living labs.

These interventions were underpinned by strong partnerships with local and national organizations, which were instrumental in their development and implementation. Key collaborators included the *Corporación Colombiana de Investigación Agropecuaria* (AGROSAVIA), which provided technical support and agroecological research; the *Resguardo Cumbal* and Municipality of Cumbal, which facilitated community engagement and governance; and SENA, which delivered capacity-building and technical training. Conservation International, through the *Naturamazonas* Project, supported biodiversity conservation and ecological restoration activities.

By leveraging local knowledge and fostering active community participation, the NATURE+ initiative in Colombia has designed interventions to address socio-economic vulnerabilities while promoting sustainable and resilient agricultural practices. This approach reflects NATURE+'s broader objectives to enhance agricultural productivity while safeguarding ecosystems, as highlighted in its strategic frameworks and ongoing partnerships.

To select the population for interviews, it is important to note that, unlike in other NATURE+ countries, the surveys conducted in Colombia did not follow a formal sampling strategy. Instead, each work package identified potential beneficiaries of the NATURE+ activities to construct a sampling framework for the interviews. This approach ensured that nearly all individuals listed as potential beneficiaries of the NATURE+ interventions in Nariño and Putumayo were included. The few who were not interviewed were either unavailable or declined to participate.

Through this process, 241 farmers in Cumbal were identified in collaboration with WP1 and WP2, with AGROSAVIA serving as the main partner. Additionally, leveraging information provided by WP3 and its partner, *NaturaAmazonas*, 50 farmers new in SAF installation process from Putumayo were identified as potential beneficiaries of WP3. Table 1 presents the total number of interviews conducted during the fieldwork in Colombia, along with a breakdown by municipality and *corregimientos* (village).

Table 1. Colombia NATURE+ household surveys distribution (by municipality and *corregimiento*)

Department	Municipality	Corregimientos (village)	No. households interviewed
Nariño (n=212)	Cumbal	Boyera	21
		Cuaical	26
		Cuaspud	8
		Cuetial	35
		Guan	30
		Guan Romerillo	5
		Llano de Piedras	1
		Quilismal	25
		Quillismal	5
		Tasmag	56
Putumayo (n=47)	Mocoa (n=4)	Alto Eslabon	2
		El Meson	2
	Puerto Guzmán (n=20)	Chichico	1
		Descanso	3
		El Bombon	4
		El Comino	1
		La Chorrera	2
		La Patria	1
		Monserrate	1
		Pacayaco	1
		San Jose De La Montaña	3
		Santa Elena	3
	Villagarzón (n=23)	Alto Mecaya	2
		La Esperanza	2
		La Kofania	2
		Las Minas	1
		Lsa Cabaña	8
		Naranjito	1
		Simon Bolivar	1
		Villa Luz	1
		Villa Rica	4
		Villa Santana	1

Source: Authors' elaboration

2.3 Questionnaires

The NATURE+ survey in Colombia combined household and community-level questionnaires to gain a comprehensive understanding of the socio-economic, agricultural, and environmental dynamics affecting potential beneficiaries of NATURE+ interventions. The survey aimed to explore practices related to NATURE-positive solutions implemented in Nariño and Putumayo.

At the household level, the survey gathered socio-economic and demographic information, including household composition, education levels, land ownership, income sources, self-employment activities, and asset ownership. Thess data offer valuable insights into the economic landscape of the population. Data were collected on agricultural practices on farms and in *chagras* (traditional agroforestry systems practiced by Indigenous communities), focusing on crop and livestock production, crop biodiversity (varieties used), and use of fertilizers and pesticides. The survey also identified the adoption of nature-positive solutions such as agroforestry, environmental management practices—including waste handling and renewable energy use—and awareness of biodiversity benefits. Furthermore, it addressed issues related to food security and dietary diversity.

Complementing the household-level data, a community-level questionnaire sought to capture insights into the socio-economic, environmental, and institutional dynamics of communities in Cumbal (Nariño) and various municipalities in Putumayo. It focused on general demographic information, including the estimated number of households, population size, and composition by gender and age, to outline the community's socio-economic profile. The survey also explored the prevalence and adoption of nature-positive practices, such as biodiversity conservation, agroforestry, and sustainable land management, while assessing their benefits and the involvement of external organizations like NGOs and extension agencies. Additionally, it looked at the community's infrastructure, natural resource governance, and existing initiatives that support sustainability.

It is important to note that all questions in the survey referred to any agricultural activities performed in 2023. From the raw survey data, an extensive set of indicators was constructed to evaluate socioeconomic, agricultural, and environmental outcomes. The subsequent sections of this report present descriptive statistics derived from the household and community surveys, disaggregated by region (Nariño and Putumayo).

3. Household survey[1]

3.1 Sample profile and livelihood

Table 2 summarizes key socio-demographic characteristics of the surveyed population, presenting both overall and regional results for Nariño and Putumayo. The average household size is 3.4 members, with no significant differences between regions, aligning closely with national figures. Female-headed households constitute 25% of the total, with a regional breakdown of 26% in Nariño and 17% in Putumayo—both significantly below the national rural average of 37% and the overall average of 45% (ECV, 2023). Despite a rising trend in female household leadership across Colombia, this lower prevalence in the two departments may reflect traditional gender norms in rural and indigenous communities, where leadership is often associated with men.

Education levels show significant variation, with most household heads having less than five years of education. While only 8% have never attended school, a notable 43% did not complete primary education, and 20% attained only primary-level completion. Secondary education accounts for 19%, and 6% achieved tertiary education, which lags behind national averages, where 28% have completed primary education, 27% secondary education, and 21% hold tertiary degrees (ECV, 2023). Regionally, Nariño shows a higher proportion of household heads with incomplete primary education (45% vs. 34% in Putumayo). However, Putumayo outperforms Nariño significantly at higher education levels, with 30% completing secondary education (vs. 16% in Nariño) and 17% achieving tertiary education (vs. 3%).

The dependency ratio, reflecting the proportion of children under 15 to adults, is 0.14 overall. Nariño households have fewer dependents (0.12) compared to Putumayo (0.24), indicating a higher proportion of working-age adults relative to children. This demographic structure in Nariño likely facilitates greater labor availability for economic activities and reduces caregiving burdens. In contrast, Putumayo's higher dependency ratio suggests greater caregiving demands, particularly on women, potentially limiting their economic participation and increasing household vulnerability. The average age of household heads is 55 years, comparable between regions (56 in Nariño vs. 54 in Putumayo).

Living standards, captured by the durable asset index, are relatively high. Most households own key assets, including smartphones (79%), vehicles (84%), and televisions (81%). Most (98%) report agricultural income and 83% derive income from animal sales or derivatives. Asset accumulation is very similar between regions (0.57 in Nariño vs. 0.57 in Putumayo), but Nariño leads in vehicle ownership (88% vs. 64%). Conversely, Putumayo has higher smartphone ownership (87% vs. 77%), likely due to better network coverage.

Both regions depend heavily on agriculture, but income disparities are notable. Annual agricultural income is significantly higher in Putumayo (6.4 million COP) than in Nariño (2.1 million COP), likely due to differences in crop types, farming systems, and market dynamics. Animal sales are more prevalent in Nariño (88% of households) than in Putumayo (71%), and income from animal sales and derivatives is higher in Nariño (8.8 million COP) than in Putumayo (6.7 million COP).

In summary, Nariño shows advantages in demographic structure, such as a lower dependency ratio and younger average age of household members, which could support labor availability and resilience. Living standards are slightly better in Nariño, as reflected in higher mobility and asset access, while Putumayo compensates with higher agricultural income, particularly from crops, and higher education levels. The two regions present similar living conditions, albeit with distinct strengths and challenges typical of the high and lowlands.

The survey in Colombia primarily focused on collecting agricultural and livestock income, although it offers valuable insights into the proportion of households earning income from various sources. Figure 2 illustrates the percentage

[1] Figures in the text have been round to integer

of households reporting income from crop production, animal sales, self-employment, non-agricultural wages, and agricultural wages across Nariño, Putumayo, and the combined total. Crop income emerges as the most reported source, with 99% of households in Nariño and 94% in Putumayo relying on it. Livestock income also represents a key contributor, with 88% of households in Nariño deriving income from this source, compared to 71% in Putumayo. Self-employment provides income for a consistent proportion of households in both regions, with approximately 17% reporting it as a source. Non-agricultural wages are slightly more prevalent in Putumayo, where 15% of households report this source, compared to 12% in Nariño. Agricultural wages are the least reported, with just over 8% of households in both regions earning income from this activity.

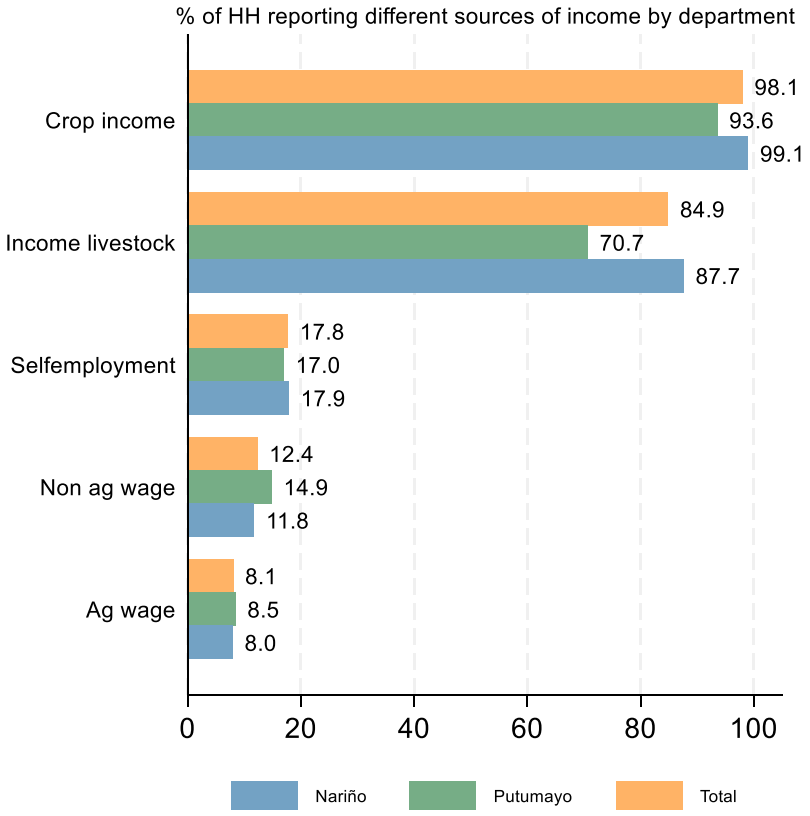
The results demonstrate that household livelihoods across both regions are similar and depend widely on the agricultural sector. The slightly higher proportion of households in Nariño relying on animal sales income is due to the Cumbal Indigenous Reserve being historically associated to its milk production, serving as a vital component of the local and regional economy, and where households practice Cuy raising (guinea pig) which is also widely raised in all Nariño. These findings provide a basis for understanding the income dynamics in these two departments.

Table 2. Socio-demographic characteristics of sampled households

Indicator	(1)	(2)	(3)	(4)
	Mean			
	Overall	Nariño	Putumayo	Diff (2)-(3)
Socio-demographic variables				
HH size	3.4	3.5	3.1	0.4
Female headed HH (%)	24.7%	26.4%	17.0%	9.4%
Age of HH head	55.5	55.8	54.5	1.3
Ratio of children (<15 years) to adults	0.14	0.12	0.24	-0.12**
Education of head (percent):				
Never been in school	8.5%	9.4%	4.3%	5.2%
Primary not completed	43.2%	45.3%	34.0%	11.2%
Primary completed	20.1%	21.2%	14.9%	6.3%
Secondary	18.9%	16.5%	29.8%	-13.3%***
Tertiary	5.8%	3.3%	17.0%	-13.7%**
Living standards				
Durable asset index (PCA)	**0.57**	**0.57**	**0.57**	-0.004
HH owns smartphone (%)	79.2%	77.4%	87.2%	-9.9%
HH owns cars and other vehicles (%)	83.8%	88.2%	63.8%	24.4%***
HH owns TV set (%)	81.1%	82.5%	74.5%	8.1%
HH agricultural income (%)	**98.1%**	**99.1%**	**93.6%**	5.4%**
Total household agricultural income (COP)	2.846.905	2.072.460	6.382.414	-4.309.953***
HH with income from animal sales/derivatives (%)	**84.9%**	**87.7%,**	**70.7%**	17%***
Total income from animal sales/derivatives (COP)	8.528.917	8.813.174	6.776.004	2.037.171

Source: Authors' elaboration.
Note: HH = household; PCA = principal component analysis; COP = Colombian pesos
Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

Figure 2. Household income sources by department



Source: Author's elaboration

3.2 Nutrition status

The Household Dietary Diversity Score (HDDS), developed under the Food and Nutrition Technical Assistance (FANTA) project, measures household dietary diversity, serving as a proxy for food access within the home. In essence, it indirectly reflects a household's economic capacity to obtain a variety of foods (Swindale & Bilinsky, 2006; Kennedy et al., 2013). The HDDS is calculated by counting the average number of food groups consumed by households in a given population, with values ranging from 1 to 12. Higher scores indicate greater dietary diversity and improved food access.

Table 3 reveals that the study population consumed an average of 9.1 food groups. However, households in Nariño reported a higher average score of 9.4 compared to 8.5 in Putumayo, indicating that households in Nariño enjoy a more diverse diet, with greater consumption of vegetables, fruits, and dairy products.

A closer examination of food group consumption shows that cereals, along with starches, tubers, and roots, are the most widely consumed food groups, with nearly 98% of households reporting their consumption. Miscellaneous items such as oils, sweets, and condiments also feature prominently in diets across both regions. On the other hand, protein-rich foods are less frequently consumed. Fish, legumes, and meat were reported by 20%, 57%, and 67% of households (overall) on the day prior to the survey. Dairy consumption, which is significantly higher in Nariño, reflects the region's robust livestock-based economy, especially in areas like the Cumbal Indigenous Reserve, known for its milk production.

Although the indicator provides the average number of food groups consumed by the population, it does not indicate whether the observed value is sufficient or adequate. To classify households based on the adequacy of their

dietary diversity, the average HDDS of the top two terciles—those with the highest dietary diversity scores—is utilized (Carbajal, 2014). The highest tercile, representing the top 33% of households with the most diverse diets, is categorized as the *adequate* diversity group. In contrast, the second tercile serves as the benchmark for the *acceptable* diversity group. This classification results in the following categories: adequate=HDDS ≥ 9, acceptable=7 ≤ HDDS < 9 and little variety=HDDS<7.

According to Figure 3, most households (68%) reported adequate dietary diversity during the reference period. However, the distribution of dietary diversity in Putumayo reveals a higher percentage of households in the "acceptable" and "low diversity" categories compared to Nariño, suggesting greater challenges in accessing a varied diet in Putumayo. One factor contributing to the higher dietary diversity in Nariño may be the widespread use of *chagras*, which are sustainable farming systems designed to grow a diverse range of crops, often integrating vegetables, fruits, tubers, grains, and medicinal plants in a single space. This method enhances access to a variety of nutrient-rich foods directly from household production, which aligns with the higher consumption of fruits, vegetables, and dairy products observed in Nariño. Beyond nutritional benefits, *chagras* also promote self-sufficiency and support balanced diets, making them a cornerstone of food security in the region.

While some households in Putumayo may practice *chagra*-style farming, this system appears less prevalent or less integrated compared to Nariño. This disparity may stem from differences in geography, agricultural traditions, or cultural priorities. Additionally, the humid tropical environment of Putumayo may limit the diversity of crops that can be grown, further contributing to the lower dietary diversity observed in the region. These findings highlight the importance of traditional systems like *chagras* in fostering dietary diversity and emphasize the need for region-specific strategies. Promoting sustainable and diverse farming practices in Putumayo could help improve access to a wider range of foods, addressing existing gaps in dietary quality.

On the other hand, the Food Insecurity Experience Scale (FIES) is a tool used to measure access to food in terms of both quantity and quality. It consists of eight questions that capture households' and individuals' experiences with food insecurity, offering an assessment of its severity (DANE, 2024). Results in

Table 3 reveals that 20% of households experience moderate to severe food insecurity, that is, due to a lack of money or other resources, 20.4 out of every 100 households in 2023 reduced the quality, variety, and quantity of the food they accessed at least once in the past 12 months. Meanwhile, the prevalence of severe food insecurity was about 1% in 2023, those results are in line with national statistics from Colombia. According to the FIES scale estimation (DANE, 2024), the prevalence of moderate or severe food insecurity among households in the country was 26% in 2023 and severe food insecurity was 5% in the period of reference.

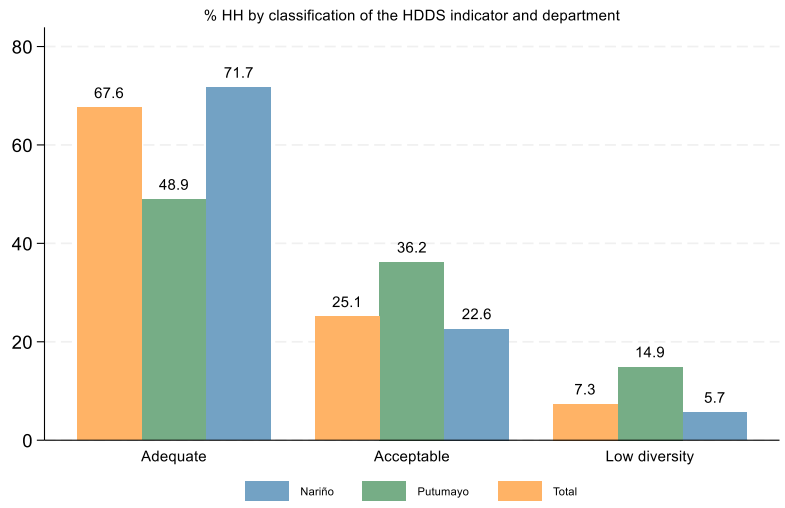
The results also reveal significant regional disparities in food security experiences between Nariño and Putumayo. Putumayo shows higher vulnerability, with more households reporting worry about food access (47%), unhealthy diets (43%), insufficient food quantity (51%), and reduced portions (43%), compared to Nariño. These findings align with Putumayo's lower dietary diversity and greater reliance on staples, highlighting barriers to accessing a varied and sufficient diet.

Table 3. Nutrition

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Household Dietary Diversity Score (HDDS)				
Household Dietary Diversity Score (mean)	9.2	9.4	8.5	0.9***
HH consumed (%)				
Cereals	98.1%	97.6%	100 %	-2.4%
Starches, tuber and roots	98.1%	98.6%	95.7%	2.9%
Vegetables	76.4%	80.6%	57.4%	23.2%***
Fruits	76.0%	82.9%	44.7%	38.2%***
Meat	67.4%	66.4%	72.3%	-5.9%
Eggs	81.4%	81.0%	83.0%	-2.0%
Fish	20.2%	19.4%	23.4%	-4.0%
Legumes	57.4%	56.9%	59.6%	-2.7%
Milk and another dairy	71.7%	78.7%	40.4%	38.3%***
Oil	92.6%	92.4%	93.6%	-1.2%
Sweets	92.6%	95.7%	78.7%	17.0%***
Condiments	87.6%	85.3%	97.9%	-12.6%**
Food Insecurity Experience Scale (FIES)				
Worry About Food Access	37.6%	35.5%	46.8%	-11.3%
Perception of Unhealthy Diet	26.4%	22.7%	42.6%	-19.9%***
Limited Food Quantity	33.2%	29.2%	51.1%	-21.9%***
Skipped Meals	8.1%	6.6%	14.9%	-8.3%*
Reduced Food Portions	21.0%	16.2%	42.6%	-26.4%***
Ran Out of Food	6.2%	6.2%	6.4%	-0.2%
Feeling Hungry	10.9%	10.4%	12.8%	-2.4%
Going Without Food for a Whole Day	2.7%	2.7%	0.0%	
Nutrition (FIES) prevalences (%)				
Prevalence of moderate-and severe Food Insecurity		20.4%		
Prevalence of moderate Food Insecurity		19.1%		
Prevalence of severe Food Insecurity		1.3%		

Source: Author's elaboration
Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

Figure 3. Households by HDDS classification



Source: Author's elaboration

3.3 Agricultural activities and practices

3.3.1 Type of agriculture

Table 4 presents a detailed overview of the farming activities typically conducted by the surveyed households and the conditions under which those agricultural activities are performed. On average, households manage no more than two parcels, with an average parcel size of 1.9 hectares (HA). Parcels are significantly bigger in Putumayo (11 HA) than Nariño (0.9 HA). The more considerable land extension in Putumayo may be likely influenced by the region's agricultural and land-use practices. For instance, 15% of households in Putumayo report maintaining virgin land or natural forests, compared to only 1% in Nariño, which can imply the former uses an agroforestry focus. In contrast, land use for animal grazing is more common among households in Nariño; 11% of households in this region had a percentage of land with this use. In both departments, the use of land is mainly focused on farming crops, followed by animal grazing and virgin land / natural forest or conservation.

Additionally, Putumayo's farming systems often include extensive plantations such as plantain, peach palm (*chontaduro*), and cacao, which usually involve larger areas. The median for the parcel size was also calculated to address the potential influence of extreme values on continuous variables. The results show a median size of 7 HA in Putumayo and 0.6 HA in Nariño, although the median reflects a smaller area, reinforcing the observed pattern of larger landholdings in Putumayo. These findings highlight distinct regional approaches to land use, with Putumayo favoring extensive agricultural systems and conservation of forestry space, while Nariño uses chagras that rely on more diversified farming and small-scale plots.

Results show that soil erosion is not a major problem in the study area; only 17% of households reported experiencing soil erosion in their parcels, which is more commonly experienced in Putumayo (28%) than in Nariño (15%). However, households in Nariño are significantly more likely to implement measures to prevent erosion (87% vs. 54%). Among these measures, minimum tillage (39%), vegetative cover (32%), crop rotation (26%), and soil conservation practices (26%) are widely adopted in Nariño, while leaving crop residues in the field (46%) and soil conservation practices (15%) are the are the most widespread among producers who managed soil erosion in Putumayo. This disparity between Nariño and Putumayo could be interpreted within the context of Indigenous worldviews, which emphasize a harmonious relationship with nature. This cultural perspective may influence the adoption of more sustainable agricultural practices, including environmentally friendly and organic methods, as well as traditional techniques for managing soil erosion.

The study zone is highly diverse, with the average percentage of households with trees on-farm being 89%. However, the percentage of households that have trees is higher in Putumayo, which is expected given that they are located in the lowlands within the Amazon-Andean foothills, making it part of a biodiversity hotspot, where conservation efforts are prominent. The type and purpose of tree use vary significantly between the regions. In Nariño, trees are primarily native (86%) and used for energy (35%) and medicinal purposes (10%). In contrast, trees in Putumayo are more often cultivated for fruit (92%), commercial purposes (68 %), and consumption (77%). Households in Putumayo commonly cultivate tree-based crops such as banana, cacao, and peach palm (*chontaduro*), which are staples in tropical agroforestry systems. These differences highlight contrasting agricultural and economic systems: Nariño households prioritize subsistence and traditional uses, while Putumayo households leverage trees for income generation and diverse consumption.

When focusing on type of crops grown, the data reflect strong regional differences, with potatoes (89%), Andean tubers (oca/ibias) (58%), broad beans (53%), and *ulluco* (48%) dominating in Nariño. These traditional crops align with high-altitude agricultural practices and Nariño's reliance on kitchen gardens (52.4%). In contrast, crops such as cassava (67%), cacao (79%), maize (52%), and peach palm (*chontaduro*, 34.0%) are more prevalent in Putumayo, reflecting its tropical lowland environment.

Table 4. Natural capital and crop activities

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Average size of parcels in HA[1]	2.8	0.9	11.5	10.63 ***
Number of parcels per HH	1.9	1.8	1.9	0.10
Soil Erosion				
HH has experienced soil erosion (%)	17.0%	14.6%	27.7%	-13.0%**
When experienced, HH uses measures to erosion (%)	77.3%	87.1%	53.8%	33.3%**
Minimum tillage	27.3%	38.7%	0.0%	38.7%**
Direct seeding or manual planting	13.6%	19.4%	0.0%	19.4%*
Planting of vegetative cover (green manure, live barriers, and live fences)	22.7%	32.3%	0.0%	32.3%**
Conservation practices (terraces, ditches, small channels, embankments, etc.)	22.7%	25.8%	15.4%	10.4%
Soil substrate preparation	18.2%	22.6%	7.7%	14.9%
Crop rotation	20.5%	25.8%	7.7%	18.1%
Leaving crop residues in the field	27.3%	19.4%	46.2%	-26.8%*
Rituals/prayers	2.3%	3.2%	0.0%	3.2%
Land use (%)				
HH with cultivated land in company (%)	3.1%	1.9%	8.5%	-6.6%**
HH uses land for animal grazing (%)	10.0%	11.3%	4.3%	7.1%
HH with land left fallow (%)	0.8%	0.0%	4.3%	-4.3%***
HH has virgin land / Natural forest or conservation (%)	3.9%	1.4%	14.9%	-13.5%***
HH has trees (%)				
HH growing trees[2]	88.8%	86.8%	97.9%	-11.1%**
Share of native trees	81.5%	85.9%	61.7%	24.1%***
Tree is a fruit tree	48.3%	38.7%	91.5%	-52.8%***
Use of tree: for wood	31.3%	32.1%	27.7%	4.4%
Use of tree: for energy	28.6%	34.9%	0.0%	34.9%***
Use of tree: for commercial	12.4%	0.0%	68.1%	-68.1%***
Use of tree: for consumption	45.2%	38.2%	76.6%	-38.4%***
Use of tree: for medicinal	8.9%	10.4%	2.1%	8.2%*
Use of tree: for forage	1.5%	0.9%	4.3%	-3.3%
Use of tree: other	14.3%	11.8%	25.5%	-13.7%**
HH grows (%)[2]:				
Potato	77.1%	89.2%	0.0%	
Oca/ibias (andean tuber)	49.8%	57.6%	0.0%	
Broad beans	45.7%	52.8%	0.0%	
Vegetable and leafy vegetable grouped[3]	45.3%	52.4%	0.0%	
Ulluco/olluco	41.6%	48.1%	0.0%	
Group of medicinal plants	34.3%	37.7%	12.1%	25.6%***
Long onion (junca)	18.0%	18.9%	12.1%	6.7%
Cassava	9.0%	0.0%	66.7%	
Maize	7.4%	0.5%	51.5%	-51.0%***
Cacao	14.6%	0.0%	78.7%	
Peach palm (Chontaduro)	6.3%	0.0%	34.0%	
Crop diversification index: Gini Simpson index	**0.6**	**0.5**	**0.8**	-0.261***

Source: Author's elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level. **Additional notes: 1** The variable represents the average farm size at the household level. First, the average farm size is calculated for each household, and the reported value is the average of these household-level averages. **2** The information presented in the table above includes only the crops with the highest frequency. Other crops, which are less frequently reported, are not shown here. **3** This category is primarily used in the case of *chagra* (a traditional cultivation plot). Usually, a *chagra* includes around 8 to 10 different types of crops within a limited area, making it cumbersome and time-consuming to record all the crop types individually. Therefore, when the plot was identified as a *chagra*, the four crops with the highest number of plants were recorded, while the remaining crops were grouped under a single category, such as "Other Aromatic Herbs" or "Vegetable and leafy vegetable grouped".

Finally, we report also the results of crop diversification index, which measures crop diversity based on the total area cultivated by the household, estimating how homogeneous the areas allocated to different crops are. If the proportion of the cultivated area is more concentrated in a single crop, a lower value of the index is expected, which would indicate lower diversity. As indicated by the Gini Simpson index, the overall diversification index reflects moderate diversity in crop cultivation (0.6). When data are disaggregated by region, there are some differences, Gini Simpson index for Putumayo is 0.8 and Nariño is 0.5. This difference suggests that while Putumayo households cultivate a broader array of crops -signaling a relatively high level of crop diversity-, there is a more balanced allocation of area (or production) across multiple crops, reducing the dominance of any single crop. In contrast, Nariño's Gini-Simpson Index of 0.5 reflects a moderate level of crop diversity, with a greater likelihood of dominance by few crops. This lower diversity could imply a more specialized agricultural system. However, the differences in the index between Nariño and Putumayo should be interpreted cautiously, considering the particularities of each region. First, the total cultivated area in Putumayo (11.5 hectares) is significantly larger than in Nariño (0.9 hectares), allowing for a greater distribution of different crops and increasing the measured diversity. In contrast, Nariño relies on the traditional chagra system, where multiple plant species are grown together in small areas. During data collection, only a few varieties of specific crops were present, a factor that could further underestimate the actual diversity collected through area proportions.

The results underscore distinct agricultural systems shaped by geography, landholding patterns, and cultural practices between Nariño and Putumayo. In Nariño, whose households are mainly Indigenous, results reflect their worldview, with the implementation of several soil conservation measures and a reliance on traditional Andean crops and *chagras*, which is a vital parcel for Indigenous people, it not only as food source but also acts as a stronghold for the preservation of their ancestral culture and food sovereignty. In contrast, Putumayo, with more extensive landholdings and a diverse crop portfolio, reflects its tropical environment and a greater focus on tree cultivation (cacao, plantain, *chontaduro*) for income and food consumption.

Table 5 presents key indicators related to livestock systems, highlighting notable regional differences between Nariño and Putumayo. On average, households own 4 different animal species, with significantly higher diversity in Nariño (4 species) compared to Putumayo (3 species). Livestock ownership is also nearly universal, with 97% of households owning animals.

While cattle (cows, heifers, or calves), poultry, and pigs are commonly raised in both regions, the types of livestock differ significantly. Guinea pigs are a hallmark of livestock systems in Nariño, where 96% of households raise them, compared to only 10% in Putumayo. Conversely, fish farming and beekeeping are more prominent in Putumayo, with 29% of households maintaining fishponds (vs. 7% in Nariño) and 12% engaged in beekeeping (vs. 0.5% in Nariño). These differences reflect Putumayo's tropical environment and larger landholdings, which accommodate activities such as aquaculture.

In terms of livestock production and animal byproducts, Nariño households are more specialized in meat (55% vs. 5% in Putumayo) and milk or other dairy products (80% vs. 26%). These patterns align with the higher prevalence of cattle and small ruminants in Nariño. In contrast, egg production is more prevalent in Putumayo, where 76.3% of households engage in this activity compared to 46% in Nariño. These distinctions highlight the contrasting farming systems: Nariño emphasizes dairy, meat, and culturally significant livestock like guinea pigs, while Putumayo focuses on poultry and fish farming.

Although both regions exhibit equal levels of livestock diversification (Gini-Simpson index is 0.4), their use of livestock reflects regional needs and practices. In Putumayo, animals such as horses and mules (34% vs. 17% in Nariño) are more commonly used for transportation and labor. Meanwhile, Nariño households rely on guinea pigs and dairy production as key components of their livelihoods.

These findings underscore the adaptability of livestock systems to local conditions. Nariño's practices are characterized by smaller-scale, intensive systems focused on dairy, meat, and traditional livestock, whereas Putumayo emphasizes poultry, fish, and livestock suited to its tropical lowland environment. These regional distinctions provide valuable insights to tailor agricultural interventions and policies to strengthen livelihoods in both areas.

Table 5. Livestock activities

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Average number of animal species	4.0	4.1	3.0	1.05***
Number of TLU owned	5.3	5.0	6.7	-1.66
HH raise (%):	97.3%	99.5%	87.2%	12.29%***
Draught cattle	0.8%	0.0%	4.9%	
Bulls	10.7%	11.8%	4.9%	6.97%
Cows/Heifers/Calves	76.6%	84.8%	34.1%	50.69%***
Goats	0.4%	0.5%	0.0%	
Sheep	15.9%	18.5%	2.4%	16.04%**
Pigs	29.0%	30.3%	22.0%	8.38%
Guinea pig (*"Cuy"*)	82.1%	96.2%	9.8%	86.45%***
Fishponds	10.3%	6.6%	29.3%	-22.63%***
Bee hives	2.4%	0.5%	12.2%	-11.72%***
Other	26.6%	30.3%	7.3%	23.01%***
Horse/Donkey/mule	19.4%	16.6%	34.1%	-17.56%***
Poultry animal	81.7%	79.6%	92.7%	-13.06%**
HH produced (%):	87.7%	86.7%	92.7%	-5.95%
Rental/Loading service	4.5%	5.5%	0.0%	
Meat products	46.2%	54.6%	5.3%	49.38%***
Milk and other dairy products	70.6%	79.8%	26.3%	53.47%***
Egg sales	51.6%	46.4%	76.3%	-29.87%***
Wool/skins/silk	12.7%	15.3%	0.0%	
Chicken manure	2.7%	2.7%	2.6%	0.10%
Other, specify	9.0%	8.7%	10.5%	-1.78%
Livestock asset index: PCA	0.4	0.5	0.32	0.17***
Livestock diversification index: Gini Simpson index	0.4	0.4	0.4	0.02

Source: Author's elaborations.
Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

3.3.2 Agricultural inputs and outputs

Table 6 provides a comprehensive analysis of agricultural inputs, focusing on seed types, fertilizers, pesticides, and herbicides. For perennial crops, native or traditional seeds are widely used by farmers across both zones, with an overall usage rate of 83%. This rate is slightly higher in Putumayo (94%) than in Nariño (80%), indicating a strong preference for traditional varieties. In contrast, the self-reported use of improved seeds is significantly higher in Putumayo (89%) compared to Nariño (33%). This disparity can be attributed to the types of crops predominant in each region. In Putumayo, improved seeds[2] are commonly associated with cacao, plantain, and fruit trees, while in Nariño improved seeds are more frequently linked to forage crops and fruit trees that are less common given the predominant potato and Andean root tubers cultivation.

In annual cropping systems, the use of native seeds remains high, with an overall usage rate of 91%. Disaggregating the data by region reveals that native seed use is overwhelmingly prevalent in Nariño (99%) compared to Putumayo (60%). This stark difference underscores the cultural and ecological importance of traditional varieties in Nariño. Conversely, the perceived use of improved seeds for annual crops is higher in Nariño (45%) than in Putumayo (17%). The lower adoption rate in Putumayo can be explained by the prevalence of annual crops such as cassava, maize,

[2] Being a self-reported measure. a substantial measurement error on the improved seed characteristics is not unlikely.

and beans, which are primarily grown for food security. For these crops, farmers tend to plant local landraces that are better adapted to the region's conditions and cultural preferences. Results further suggest that the higher utilization of native seeds in Nariño represents a deliberate choice by farmers, influenced not by economic or availability constraints, but by the cultural and ecological significance of traditional practices. This choice aligns with the Indigenous view, which prioritizes the preservation of traditional seeds, particularly using *chagras*[3] as a key mechanism for sustaining biodiversity. In contrast, although in the lowlands there is also high percentage reporting use of traditional varieties, the reason for choosing native seeds is more related to availability and access to improved seeds, alongside a deliberate preference for traditional varieties in Nariño (98% vs. 63% in Putumayo).

Finally, a significant proportion of farmers reported using both native and improved seed types in at least one crop. The overall percentage of farmers adopting both types of seed is 43% for perennial crops and 35% for annual crops. This mixed approach highlights a level of diversification in farming practices that combines traditional and modern inputs. In summary, the findings on seed types reveal that traditional or native seeds remain the predominant choice among the surveyed farmers, reflecting their cultural and ecological value. Improved seed use, while less common, is influenced by crop types and regional agricultural practices, illustrating a nuanced balance between tradition and modernity in farming systems.

On the input side, overall, 94% of households used organic fertilizer during the period of reference 2023 and 74% used inorganic fertilizer. When comparing input use between regions, fertilizer application reveals notable differences. While a significant percentage of households reported using organic fertilizers in both Nariño and Putumayo, the prevalence is substantially higher in Nariño (97% compared to 81% in Putumayo). This difference may be attributed to Nariño's cultural emphasis on traditional and sustainable agricultural practices, which aligns with the widespread use of organic fertilizers. In contrast, the higher use of inorganic fertilizers in Nariño could be explained by differences in soil nutrient requirements, which arise from the distinct agroecological zones and types of crops grown in each region. Specifically, farmers in Cumbal tend to cultivate annual and Andean crops, while Putumayo's agriculture is more oriented towards permanent crops. Among households using inorganic fertilizers, NPK is the most widely used fertilizer (67% overall), with significant regional difference (71% in Nariño vs. 32% in Putumayo). Significant variations in the average quantity of fertilizer (organic and inorganic) were also observed, with Putumayo reporting lower quantities of fertilizer.

Pesticide use is also widespread in both zones, with 71% of households reporting its application overall, while herbicide use is comparatively lower at 30%. While there is no statistically significant difference in the percentage of farmers using herbicide between regions, substantial regional disparities are evident in pesticide usage. Households in Nariño report pesticide use at nearly double the rate of those in Putumayo, likely reflecting variations in agroecological conditions and pest pressures that influence crop protection needs.

On the other hand, irrigation practices remain limited across the surveyed households, with only 20% reporting any form of irrigation. Among those using irrigation, sprinkling is the predominant method, accounting for an average of 84% of all irrigation practices. Notably, all households reporting irrigation are located in Nariño (Cumbal), where it is primarily associated with the cultivation of potatoes and pasture.

[3] A *chagra* is a traditional agricultural system practiced by Indigenous communities, especially in regions like Nariño. It is an agroforestry system integrating ecological, cultural, and social dimensions, fostering biodiversity, maintaining soil fertility through fallow periods, and serving as a site for the transmission of ancestral knowledge. It plays a vital role in food security and the preservation of cultural identity (Piarpusan Pismac et al., 2019; Gobernación de Putumayo & Instituto Interamericano de Cooperación para la Agricultura, 2020).

Table 6. Agricultural inputs

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Seed types for perennial crops[1]				
HH that perceive using improved seeds (%)	43.6%	33.5%	89.4%	-55.9%***
HH that perceive using native seeds (%)	82.6%	80.2%	93.6%	-13.4%**
HH that perceive using both types of seed (%)	43.2%	44.3%	38.3%	6.0%
Seed types for annual crops[1]				
HH that perceive using improved seeds (%)	39.8%	44.8%	17.0%	27.8%***
HH that perceive using native seeds (%)	91.5%	98.6%	59.6%	39.0%***
HH that perceive using both types of seed (%)	35.1%	39.6%	14.9%	24.7%***
Reason for choosing native seeds for annual crops (%)				
Lack of access to improved seeds	7.9%	6.2%	20.0%	-13.8%***
Preference for traditional variety	93.4%	97.6%	63.3%	34.3%***
Improved varieties are not available or do not suitable to the production needs	17.8%	13.3%	50.0%	-36.7%***
Improved varieties are too expensive	5.8%	5.2%	10.0%	-4.8%
Other	7.9%	8.5%	3.3%	5.2%
HH used organic fertilizers (%)	94.2%	97.2%	80.9%	16.3%***
HH used inorganic fertilizers (%)	74.5%	80.7%	46.8%	33.9%***
Urea	1.6%	1.2%	4.5%	-3.4%
NPK	66.8%	71.3%	31.8%	39.5%***
D. Compound	13.0%	14.6%	0.0%	14.6%*
Yara (and other branded blends)	3.6%	3.5%	4.5%	-1.0%
Lime	2.1%	1.8%	4.5%	-2.8%
A combination	5.2%	5.8%	0.0%	5.8%
Other	14.5%	8.8%	59.1%	-50.3%***
Fertilizer organic use (Ton/HA)[2]	3.4	4.1	0.1	3.967*
Fertilizer Inorganic use (Ton/HA)[2]	0.3	0.3	0.1	0.255
HH used pesticide (% percent)	71.0%	77.4%	42.6%	34.8%***
HH used herbicide (% percent)	30.1%	28.3%	38.3%	-10.0%
Households with soil irrigation[3]	**19.7%**	**24.1%**	**0.0%**	
Types of irrigation used in households (%)				
Sprinkling	84.3%	84.3%	0.0%	
Drip	5.9%	5.9%	0.0%	
Pumping	7.8%	7.8%	0.0%	
Gravity	2.0%	2.0%	0.0%	

Source: Author's elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

[1] This variable represents the number of households that have at least one crop where improved/ traditional seeds are perceived to be used. The "Perennial Crops" category encompasses crops and trees (e.g., medicinal, timber, or forest species) that may or may not be intended for commercial purposes.

[2] Average quantity for all plots during agricultural year 2023

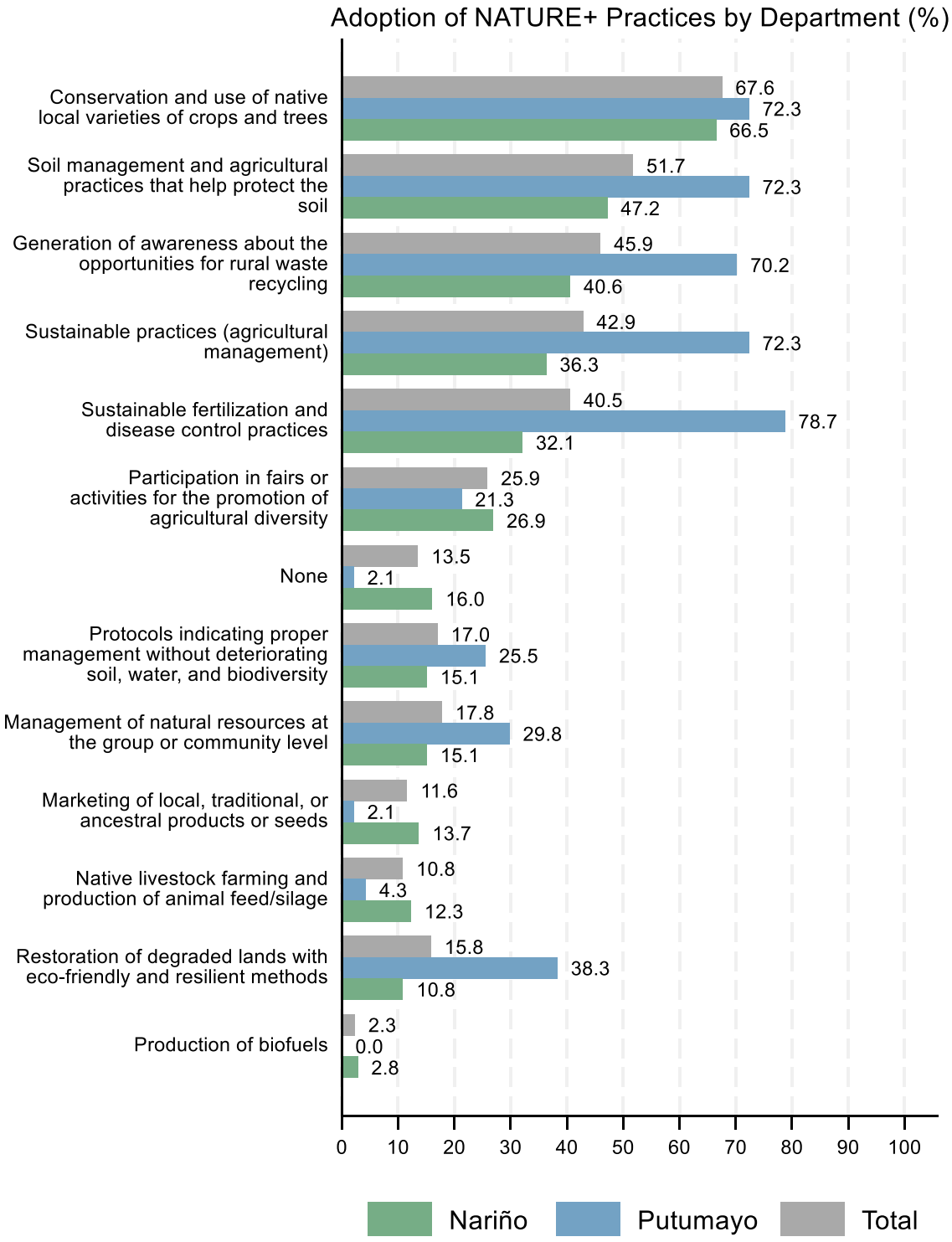
[3] All households with irrigation use surface water (rivers and/or lakes) as a source.

3.3.3 NATURE+ practices

Figure 4 provides an overview of household NATURE+ practices related to conservation, agriculture, and environmental sustainability across the two regions examined in this study. Unlike other NATURE+ countries, and in alignment with the objectives of this study, the Nature+ practices for Colombia were consolidated into 12 thematic categories rather than surveying households about 46 individual practices, as done elsewhere (see Table A3 for

details). This categorization provides a more streamlined approach to assessing the adoption of Nature+ practices in Colombia.

Figure 4. Adoption of NATURE+ practices by department



Source: Author's elaboration

The result provides a self-reported measure of adoption of NATURE+ practices. Figure 4 reflects the adoption rates of various Nature+ practices across the regions of Nariño and Putumayo, as well as the total aggregated percentage. The data highlights some differences in the implementation of conservation, agricultural, and sustainability practices between the two regions. The most widely adopted practices are conservation and use of local native varieties of crops and trees (67.6%) and soil management and agricultural practices that help protect the soil (51.7%). These practices reflect a strong awareness of biodiversity conservation and soil health across both regions which is in line with the results previously discussed (Table 4). Putumayo shows higher adoption rates for these practices (72.3% each) compared to Nariño (66.5% and 47.2%, respectively), likely driven by greater dependency on traditional agriculture and specific efforts to mitigate soil degradation. Similarly, raising awareness about rural waste recycling is more prominent in Putumayo (70.2%) than in Nariño (40.6%), indicating stronger waste management initiatives in the former.

Intermediate levels of adoption are observed for practices like sustainable agricultural management (43%) and sustainable fertilization and disease control (41%). These practices show higher adoption in Putumayo (72% and 79%, respectively) compared to Nariño (36% and 32%). This results also can explain the low levels of chemical inputs in Putumayo reported in Table 4 compared with Nariño. Conversely, Nariño leads in participation in fairs or activities to promote agricultural diversity (27% vs. 21% in Putumayo), reflecting slightly stronger market-oriented initiatives in this region.

The data underscores the varying levels of NATURE+ practices adoption between Nariño and Putumayo. While Putumayo demonstrates higher adoption in sustainable practices, Nariño shows relative strengths in promoting agricultural diversity and conserving traditional crops.

Table 7. Household familiarity with NATURE+ practices

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Number of NATURE+ practiced on average	3.6	3.4	4.9	-1.54***
HH has been using (at least 1) NATURE+ for (%)				
Less than 1 year	4.0%	2.8%	8.7%	-5.88%
about 1 year	4.9%	6.2%	0.0%	
Between 1 and 2 years	12.1%	9.6%	21.7%	-12.1%*
Between 2 and 5 years	17.0%	15.3%	23.9%	-8.6%
More than 5 years	61.9%	66.1%	45.7%	20.4%
NATURE+ source of information (%):				
None	1.8%	1.7%	2.2%	-0.4%
NGO/Other organizations	35.0%	33.3%	41.3%	-7.9%
Public extension agents/ Ministry of Ag	9.9%	9.6%	10.9%	-1.2%
Relatives/Friends/Neighbors	36.8%	40.7%	21.7%	18.9%
Schools or other training events	12.1%	11.3%	15.2%	-3.9%*
Media and Internet	0.5%	0.0%	2.2%	
Other	4.0%	3.4%	6.5%	-3.1%

Source: Author's elaboration
Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

According to the results shown in Table 7, farmers implemented an average of 4 Nature+ practices on their plots during the reference period. The number of practices adopted was significantly higher in Putumayo (5) than in Nariño (3). Regarding the duration of use, 62% of respondents reported having used at least one Nature+ practice for more than five years. This proportion was notably higher in Nariño (66%) than Putumayo (46%). Conversely, newer adopters (those who reported less than one year of use) were more prevalent in Putumayo (9%) compared to Nariño (3%).

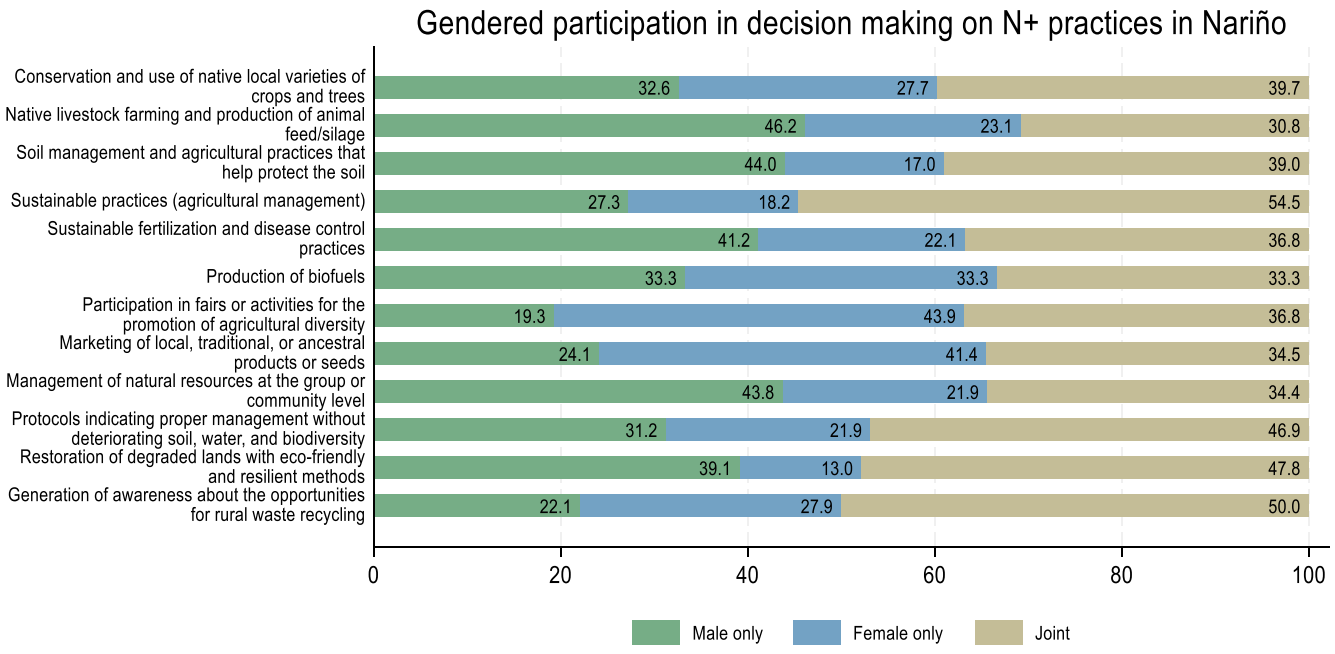
Most farmers' primary source of information about considered practices was through community networks, such as relatives, friends, and neighbors (37%), followed by NGOs and institutions (35%). Community networks were particularly influential in Nariño, where 41% of farmers cited them as their primary source, compared to 22% in Putumayo. On the other hand, NGOs and institutions played a more prominent role in Putumayo (41%) than in Nariño (33%), underscoring the impact of external initiatives in promoting related Nature+ practices in Putumayo. The findings suggest that practices have a longer-term integration in Nariño, indicating they are well-established and embedded within the region's agricultural systems. In contrast, the higher intensity of practice adoption in Putumayo and the presence of formal information sources could reflect the success of recent outreach and intervention programs in the region.

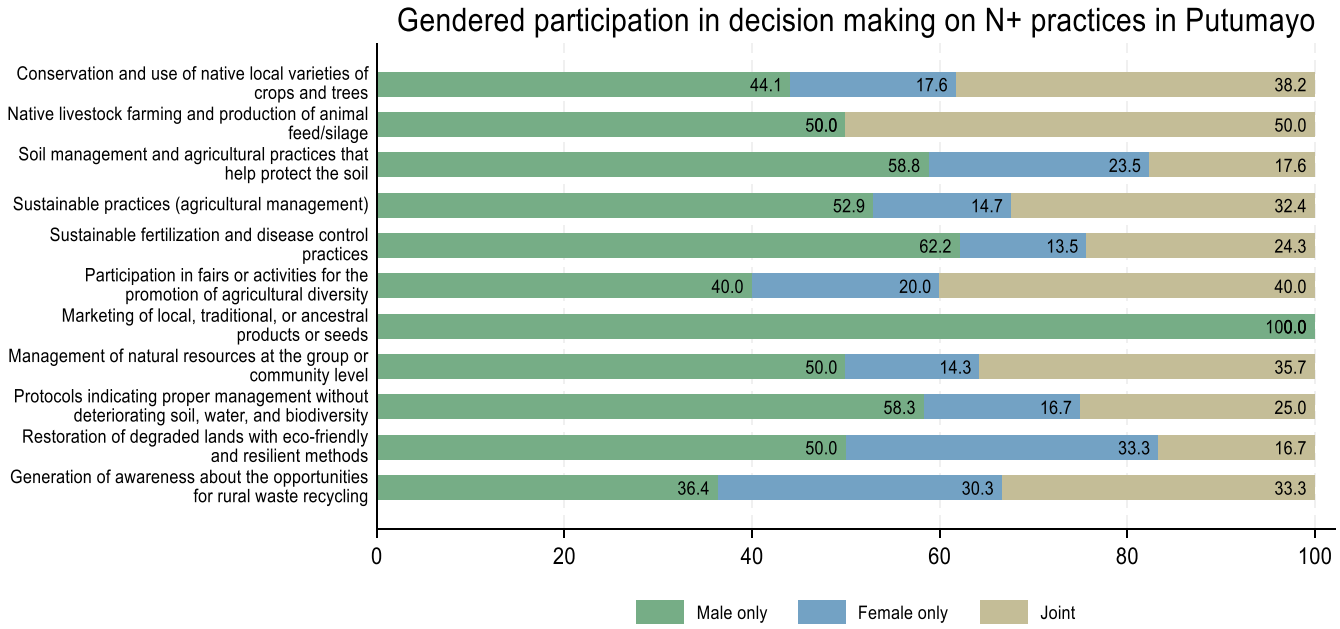
Tailored strategies are necessary to further enhance the adoption of Nature+ practices. In Nariño, strengthening formal dissemination channels can complement its well-established community networks. Meanwhile, in Putumayo, continuing and scaling up NGO-led and institutional efforts can sustain and expand the recent gains. These region-specific approaches can ensure broader and more sustainable integration of Nature+ practices across both areas.

Decision-making was categorized into three groups: male-only, female-only, and joint. Joint decision-making was highly prevalent in most categories of practices. Raising awareness about the opportunities for rural waste recycling and sustainable practices exhibits the highest levels of joint participation. Female-only decision-making is more prevalent in areas related to participation in fairs and promotional activities, production of biofuels, and recycling. In contrast, male-only decision-making dominates practices associated with technical and farm activities, such as soil management, sustainable fertilization and pest control, and livestock farming.

Figure 5, reveals entrenched gender norms by region. Male dominance is evident in technical and resource-intensive practices, female-only participation is limited, and the level of joint decision-making varies between regions. Nariño demonstrates stronger collaboration through higher levels of joint decision-making, while Putumayo reflects more traditional, male-led roles. These results underscore the importance of integrating gender-responsive approaches to enhance the adoption of N+ solutions and ensure inclusiveness in sustainable agricultural practices, which can improve the effectiveness of agricultural interventions.

Figure 5 Gendered participation in decision-making on NATURE+ practices, by zone





Source: Author's elaboration

3.3.4 Agricultural production and market access

Table 8 provides an overview of key agricultural production indicators, including the average area planted per crop (ha), average quantity harvested (ton), and yield (ton/ha), for the top ten of the most frequent crops cultivated by the surveyed population. Consistent with patterns observed in previous tables, notable differences emerge between the two regions, reflecting the distinct agroecological zones of lowlands and highlands.

In Nariño, traditional Andean crops such as potatoes (0.2 ha), oca/ibias (0.1 ha), and *ulluco/olluco* (0.1 ha) show the main land allocation, these crops underline a strong connection to historical agricultural practices in the highlands, driven by cultural practices and local food security needs. In contrast, these crops are absent in Putumayo, where land is predominantly allocated to tropical cash crops, including cassava (0.4 ha), cacao (3 ha), and peach palm (2.5 ha). However, maize is an important crop in both regions.

The comparison of crop yields between the national averages and the yields observed in Nariño and Putumayo according to data from *Evaluaciones agropecuarias municipales (EVA 2023)*, reveals some crops demonstrate competitive performance, particularly in Putumayo, most yields fall below national benchmarks, signaling gaps in productivity. Potato yields in Nariño, at 14.5 tons/ha, fall notably short of the national average of 19.2 tons/ha. Similarly, Andean tubers such as oca/ibias (8.9 tons/ha) and *ulluco* (5.8 tons/ha) perform well below their respective national averages of 12.0 and 11.3 tons/ha. Long onion yields in Putumayo, though higher than Nariño, reach 14.2 tons/ha, significantly below the national standard of 25.5 tons/ha. In contrast, cassava in Putumayo achieves 10.6 tons/ha compared to the national average of 10.1 tons/ha, highlighting the region's favorable conditions. Similarly, maize in Putumayo performs exceptionally at 6.1 tons/ha, more than double the national benchmark of 3.0 tons/ha, showcasing efficient practices. However, maize yields in Nariño are critically low at 0.3 tons/ha. For cacao and *chontaduro*, yields in Putumayo (0.14 and 0.8 tons/ha) remain well below the national averages (0.5 and 5.3 tons/ha).

Table 8. Agricultural production

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Average area planted per crop (HA)				
Potato	0.2449	0.2449	0.000	
Oca/ibias (Andean tuber)	0.1042	0.1042	0.000	
Broad beans	0.1122	0.1122	0.000	
Vegetable and leafy vegetable grouped	0.0688	0.0688	0.000	
Ulluco/olluco	0.1139	0.1139	0.000	
Group of medicinal plants[1]	0.0518	0.0534	0.0212	0.0323
Long onion (*junca*)	0.0712	0.0768	0.0060	0.0708
Cassava	0.4508	0.0000	0.4508	
Maize	0.8132	0.7150	0.8283	-0.1133
Cacao	2.992	0.000	2.992	
Peach palm (*Chontaduro*)	2.524	0.000	2.524	
Average quantity harvested per crop (TON)				
Potato	2.077	2.077	0.000	
Oca/ibias (Andean tuber)	0.124	0.124	0.000	
Broad beans	0.215	0.215	0.000	
Vegetable and leafy vegetable grouped[1]	0.259	0.259	0.000	
Ulluco/olluco	0.090	0.090	0.000	
Group of medicinal plants	0.159	0.034	2.505	-2.4708***
Long onion (*junca*)	2.030	0.032	25.008	-24.9760***
Cassava	0.893	0.000	0.893	
Maize	1.532	0.315	1.719	-1.4038
Cacao	0.4165	0.000	.4165	
Peach palm (*Chontaduro*)	2.757	0.000	2.757	
Yield (Ton/HA)				
Potato	14.513	14.513	0.000	
Oca/ibias (Andean tuber)	8.903	8.903	0.000	
Broad beans	10.704	10.704	0.000	
Vegetable and leafy vegetable grouped[1]	9.853	9.853	0.000	
Ulluco/olluco	5.827	5.827	0.000	
Group of medicinal plants	2.060	1.470	16.813	-15.3422***
Long onion (*junca*)	8.693	8.328	14.167	-5.8384
Cassava	10.646	0.000	10.646	
Maize	5.325	0.335	6.093	-5.7576
Cacao	0.1392	0.000	0.1392	
Peach palm (*Chontaduro*)	0.8105	0.000	0.8105	

Source: Authors' elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Tests were conducted at a 95% confidence level.

1 This category is primarily used in the case of *chagra* (a traditional cultivation plot). Usually, a *chagra* includes around 8 to 10 different types of crops within a limited area, making it cumbersome and time-consuming to record all the crop types individually. Therefore, when the plot was identified as a *chagra*, the four crops with the highest number of plants were recorded, while the remaining crops were grouped under a single category, such as "Other Aromatic Herbs" or "Vegetable and leafy vegetable grouped."

Table 9. Market access: Crop activities

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Market participation				
Potato	80.0%	80.0%	0.0%	
Oca/ibias (Andean tuber)	66.7%	66.7%	0.0%	
Broad beans	72.9%	72.9%	0.0%	
Vegetable and leafy vegetable grouped[1]	88.7%	88.7%	0.0%	
Ulluco/olloco	63.6%	63.6%	0.0%	
Group of medicinal plants	82.4%	83.9%	50.0%	33.9%*
Long onion (*junca*)	94.2%	95.8%	75.0%	20.8%*
Cassava	62.5%	0.0%	62.5%	
Maize	63.6%	66.7%	63.2%	3.5%
Cacao	41.3%	0.0%	41.3%	
Peach palm (*Chontaduro*)	64.0%	0.0%	64.0%	
Marketed share (qty sold/qty harvested)				
Potato	81.6%	81.6%	0.0%	
Oca/ibias (Andean tuber)	92.1%	92.1%	0.0%	
Broad beans	91.6%	91.6%	0.0%	
Vegetable and leafy vegetable grouped[1]	91.5%	91.5%	0.0%	
Ulluco/olluco	92.1%	92.1%	0.0%	
Group of medicinal plants	98.2%	98.1%	100.0%	-1.9%
Long onion (*junca*)	87.4%	87.4%	87.5%	-0.1%
Cassava	74.9%	0.0%	74.9%	
Maize	80.1%	100.0%	77.0%	23.0%
Cacao	94.9%	0.0%	94.9%	
Peach palm (*Chontaduro*)	87.8%	0.0%	87.8%	
Marketed share (value sold/value harvested)				
Potato	68.8%	68.8%	0.0%	
Oca/Ibias (Andean tuber)	58.0%	58.0%	0.0%	
Broad beans	73.1%	73.1%	0.0%	
Vegetable and leafy vegetable grouped[1]	68.7%	68.7%	0.0%	
Ulluco/olluco	56.8%	56.8%	0.0%	
Group of medicinal plants	75.9%	75.9%	0.0%	
Long onion (*junca*)	58.2%	58.7%	50.0%	8.7%
Cassava	58.2%	0.0%	58.2%	
Maize	55.3%	100.0%	46.3%	53.7%*
Cacao	94.3%	0.0%	94.3%	
Peach palm (*Chontaduro*)	83.4%	0.0%	83.4%	

Source: Authors' elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level.

1 This category is primarily used in the case of *chagra* (a traditional cultivation plot). Usually, a *chagra* includes around 8 to 10 different types of crops within a limited area, making it cumbersome and time-consuming to record all the crop types individually. Therefore, when the plot was identified as a *chagra*, the four crops with the highest number of plants were recorded, while the remaining crops were grouped under a single category, such as "Other Aromatic Herbs" or "Vegetable and leafy vegetable grouped."

The analysis of market access indicators for crop activities Table 9 in reveals a relatively high market participation rate across most key crops, underscoring their commercial importance. Crops such as vegetables and leafy greens, potatoes, broad beans, *oca/ibias*, and *ulluco/olluco*, cultivated exclusively in Nariño, exhibit strong engagement in both production and sales, reflecting their importance to local markets.

Crops grown in both regions, such as medicinal plants, long onion, and maize, also display high market participation overall. However, while no statistically significant differences are observed between regions for these crops, maize shows a relatively lower market participation rate in Putumayo. This discrepancy suggests that maize production in Putumayo may be more oriented toward subsistence consumption, while Nariño demonstrates greater commercialization for the crop.

For crops exclusively cultivated in Putumayo—including cassava, cacao, and peach palm—market participation rates remain moderate to high, indicating their relevance to the region's agricultural economy. However, these rates are lower compared to other crops, particularly those produced in Nariño.

The analysis of market shares (quantity sold relative to harvested) provides valuable insights into households' market integration. The data indicate that farmers exhibit a high market orientation, with only a small percentage of crops retained for household consumption. Across both Nariño and Putumayo, the proportion of harvested crops sold remains consistently high, with minimal regional differences observed. This strong commercialization reflects the importance of market access for rural livelihoods, even as regional crop specialization shapes production patterns.

The marketed share of value sold relative to harvested highlights the economic performance of frequent crops for surveyed household, overall and across both regions. At the overall level, tropical crops like cacao (94.3%) and peach palm (83%) demonstrate strong market integration, reflecting their demand and established connections to specialized markets. Meanwhile, traditional Andean crops such as *oca/ibias* (58.0%), *ulluco* (57%), and potatoes (69%) show moderate value capture. Despite achieving high quantities sold, these crops struggle to realize their full economic potential due to lower prices, weaker market linkages, or market saturation.

In Nariño, prevalence is the highest for maize (100%), signifying its strong commercialization and consistent market demand. Crops like potato (69%) and long onion (59%) achieve moderate marketed value shares, reflecting stable sales but limited price realization. Andean tubers, while culturally significant, remain economically underutilized. In Putumayo, tropical crops demonstrate a comparative advantage. Cacao (94%) and peach palm (83%) perform well, underscoring their economic importance. However, crops like maize (46%) and long onion (50%) face significant inefficiencies, likely due to high local consumption and weak market access, which limit value capture.

Overall, while tropical crops in Putumayo and staple crops in Nariño highlight regional strengths, both regions face challenges in achieving higher value capture for key crops. Addressing these constraints—through improved market linkages, infrastructure, and price stabilization—will enhance economic returns and support sustainable agricultural development.

Table 10 examines the total values of livestock sales and derived products, as well as market participation rates regarding livestock activities across overall households, and by region. The findings highlight notable differences in economic engagement and income generation from livestock-related activities between the two regions. Results show that while households in Nariño exhibit a higher rate of market participation in livestock sales (75%) compared to Putumayo (60%), the total value of livestock sales is significantly higher in Putumayo (COP 3,568,830 vs. COP 2,061,896). This suggests that although fewer households in Putumayo participate in the livestock market, they generate more income per sale.

Table 10. Market Access: Livestock activities

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Total value of livestock[1] sales (COP)	2.335.355	2.061.896	3.568.830	-1.506.933**
Total value of livestock products sales (COP)	4.744.634	5.628.845	756.279	4.872.566***
Meat products	377.232	341.930	2.142.350	-1.800.420*
Milk and other dairy products	7.519.462	7.876.083	2.312.800	5.563.283.00
Egg	118.078	62.688	280.428	-217.739.36**
Chicken manure	123.056	123.056	-	
Market participation, livestock[2] (%)	72.2%	75.0%	59.6%	15.4%**
Market participation, livestock products[3] (%)	60.2%	65.1%	38.3%	26.8%***
Meat products	27.5%	26.0%	100.0%	-74.0%**
Milk and other dairy products	82.1%	84.2%	50.0%	34.2%***
Egg	17.5%	8.2%	44.8%	-36.6%***
Chicken manure	35.7%	35.7%	0.0%	

Source: Authors' elaboration
Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * p < 0.10, ** p < 0.05, *** p < 0.01. Tests were conducted at a 95% confidence level. Additional notes:
[1] Livestock refers to domesticated animals raised in an agricultural setting. It includes cattle, guinea pigs, poultry, and other animals kept for farming or production purposes.
[2] Corresponds to the number of households that sell any type of animal divided by the total number of households.
3 Corresponds to the number of households that sell any animal products divided by the total number of households.

In contrast, Nariño leads in the value of animal by-product sales, with an average of COP 5,628,845 compared to COP 756,279 in Putumayo. This discrepancy is primarily driven by dairy production, where Nariño generates an impressive COP 7,876,083 in sales, far surpassing Putumayo's COP 2,312,800. These findings underscore the importance of dairy farming as a key economic driver in Nariño, reflecting a focus on value-added production, this is also explained due in this zone there are several dairy-producing companies. When analyzing other by-products, the trends shift. Putumayo outperforms Nariño in average sales of meat products (COP 2,142,350 vs. COP 341,930) and eggs (COP 280,428 vs. COP 62,688). This highlights a specialization in meat and egg production in Putumayo, suggesting different economic priorities and market dynamics between the regions.
Market participation rates also provide critical insights. Nariño maintains a higher overall participation in selling livestock products (65%) compared to Putumayo (38%), particularly in dairy products (84% vs. 50%). However, Putumayo shows higher participation rates for meat products (100% vs. 26%) and eggs (44% vs. 8%). In summary, Nariño demonstrates strength in value-added production, particularly in dairy markets, which serve as a cornerstone of its livestock economy. Conversely, Putumayo's dominance in livestock sales and its focus on meat and egg production reveal a complementary economic strategy.

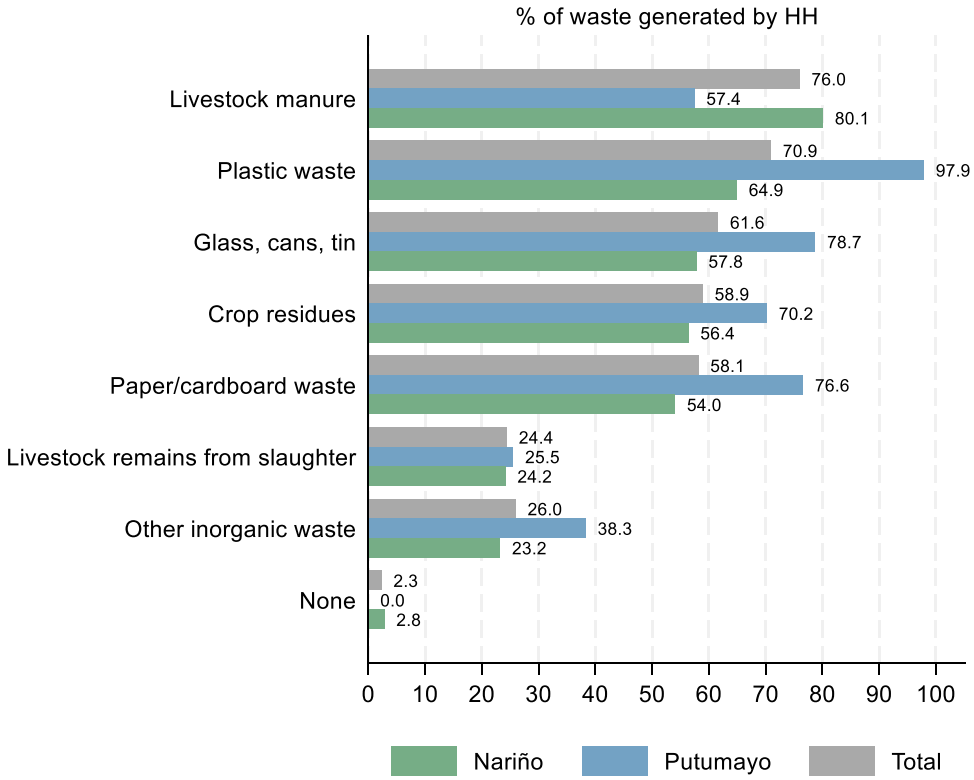
3.3.5 Waste management and energy sources

One of the pillars that the Nature-Positive Solutions Initiative promotes is adequate waste management for transforming waste into resources while reducing environmental harm. By composting and recycling organic waste, soil fertility is restored, pollution is minimized, and biodiversity is protected. Sustainable practices reduce methane emissions, support climate resilience, and foster economic opportunities through resource recovery, such as biogas production. Integrating waste management ensures agricultural systems enhance ecosystem health, mitigate climate impacts, and support sustainable livelihoods, creating a balance between agriculture and environmental conservation.

To understand the practices about waste production and disposal of surveyed population, we asked about the types of waste generated by households during the period of reference 2023. According to Figure 6, the overall data on waste generation highlights that livestock manure constitutes the most common type of waste between households, making up 76%. Plastic waste is the second most significant category, accounting for 65%, followed by glass, cans,

and tins at 71%. Crop residues contribute 59% to the total, while paper and cardboard waste make up 58%. Livestock remains from slaughter represent 24%, and other inorganic waste accounts for 26%. A very small proportion of households (2%) report generating no waste.

Figure 6. Waste generated by households



Source: Authors' elaboration

Table 11 provides insights into how households manage the waste disposal of different types of waste in the study zone; the findings reveal that organic waste, including livestock manure and crop residues, is primarily reintegrated into the soil as fertilizer or left on the land. Plastic and paper/cardboard waste, in contrast, are largely incinerated or sold. The data indicates that 59% of households incinerate plastic waste, while 15% sell it. Incineration of this type of waste is particularly prominent in Nariño, compared to Putumayo. Similarly, 67% of paper and cardboard waste is incinerated, and 12% is sold. The predominant disposal method for glass, cans, and tin is sales, reported by 76% of households overall. Regional disparities are evident, with 82% of households in Nariño selling these materials compared to 54% in Putumayo, where a notable 24% of households resort to burying them, in contrast to only 3% in Nariño. These differences suggest the need for more recycling initiatives across regions.

Animal remains from slaughter are disposed of through either burial or use as soil fertilizer, with significant variation between regions. In Nariño, 39% of households utilize these remains for fertilization, whereas this method is absent in Putumayo, where 42% of households bury them. Inorganic waste, such as fertilizers, pesticides, and chemicals, is predominantly incinerated (40%) or buried (24%). Regional differences are again notable, with incineration being more common in Nariño (49%), while burial is more frequently reported in Putumayo (39%).

In summary, the results underscore that although organic waste is relatively well managed because, in most cases, it is reincorporated into the soil, managing inorganic waste points to gaps in waste management infrastructure and practices. In particular, handling inorganic and hazardous materials, including incineration and burial, highlights pressing environmental challenges and the need for targeted interventions to promote sustainable waste management strategies.

Table 11. Waste management, by type of waste

Indicator[1]	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff[2] (2)-(3)
Livestock manure (%)	**76.0%**	**80.1%**	**57.4%**	**22.7%*** **
Use them for soil fertilization	71.4%	74.0%	55.6%	18.4%*
Thrown on land (landfill, pits)	16.8%	17.8%	11.1%	6.7%
Send them to the compost heap	7.1%	5.9%	14.8%	-8.9%
Other	4.7	2.3%	18.5	-16.2%
Plastic waste (%)	**70.9%**	**64.9%**	**97.9%**	**-33%*** **
Incineration	59.0%	62.8%	47.8%	15%
Sold	14.8%	13.9%	17.4%	-3.5%
The reused ones	7.1%	6.6%	8.7%	-2.1%
Other	19.1%	16.7%	26.1%	-9.3%
Glass, cans, tin (%)	**61.6%**	**57.8%**	**78.7%**	**-20.9%*** **
Sold	75.5%	82.0%	54.1%	27.9%**
Buried	8.2%	3.3%	24.3%	21%
Other	16.3%	14.7%	21.6%	-6.9%
Crop residues (%)	**58.9%**	**56.4%**	**70.2%**	**-13.8%***
Use them for soil fertilization	63.8%	60.5%	75.8%	-15.3%
Thrown on land (landfill, pits)	18.4%	22.7%	3.0%	19.7%
Send them to the compost heap	9.9%	8.4%	15.2%	-6.8%
Other	7.9%	8.4%	6.0%	2.4%
Paper/cardboard waste (%)	**58.1%**	**54.0%**	**76.6%**	**-22.6%*** **
Incineration	66.7%	71.9%	50.0%	21.9%
Sold	12.0%	13.2%	8.3%	4.9%
Other	21.3%	14.9%	41.7%	-26.8%
Livestock remains from slaughter (%)	**24.4%**	**24.2%**	**25.5%**	**-1.3%**
Use them for soil fertilization	31.7%	39.2%	0.0%	
Buried	20.6%	15.7%	41.7%	-26%
Send them to the compost heap	17.5%	17.6%	16.7%	0.9%
Thrown on land (landfill, pits)	15.9%	11.8%	16.7%	-4.9%
Other	14.3%	15.7%	24.9%	-9.2%
Other inorganic waste (fertilizers, pesticides, other chemicals, etc.) (%)	**26.0%**	**23.2%**	**38.3%**	**-15.1%** **
Incineration	40.3%	49.0%	16.7%	32.3%
Buried	23.9%	18.4%	38.9%	-20.5%
Thrown on land (landfill, pits)	6.0%	2.0%	16.7%	-14.7%
Other	29.8	30.6	27.7	2.9
None	**2.3%**	**2.8%**	**0.0%**	

Source: Authors' elaboration

Note: [1]Percentages in bold represent the proportion of households that generate the specific type of waste. Based on that percentage, the types of waste disposal methods are reported

[2]The differences marked in light gray do not allow for the calculation of a proportion difference test, as the number of successes is less than 5, especially in Putumayo.

Table 12. Use of energy and fuels among households

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Household energy sources (%)				
Electrical Energy Public Service	97.3%	100.0%	84.4%	15.56%***
Solar panel	3.5%	0.5%	17.8%	-17.30%***
Fuel-powered electricity generator	0.4%	0.0%	2.2%	
Types of fuel used in households (%)				
Gas	89.2%	90.1%	85.1%	5.00%
Firewood from own harvest	64.5%	67.0%	53.2%	13.80%*
Gasoline or diesel	53.3%	50.0%	68.1%	-18.10%
Collected firewood	25.5%	22.2%	40.4%	-18.20%**
Charcoal	10.0%	11.8%	2.1%	9.70%
Kerosene	1.2%	1.4%	0.0%	
Briquettes	0.8%	0.5%	2.1%	-1.60%
Other	0.4%	0.0%	2.1%	

Source: Authors' elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Tests were conducted at a 95% confidence level.

On the other hand, the importance about sustainable energy sources lies in decreasing dependency on non-renewable energy, for that reason Nature positive solution is interested in promoting alternatives to help communities to better manage waste and energy sources, for example, converting organic waste into renewable energy sources, such as biogas, to support environmentally friendly practices in agriculture and rural livelihoods. The data in Table 12 indicates that the primary energy source for households is public electricity, used by 97% of respondents overall. However, regional differences exist, with 100% of households in Nariño using public electricity compared to 84% in Putumayo. Solar panels are more commonly used in Putumayo (18%) than in Nariño (0.5%). Fuel-powered electricity generators are used by 2% of households in Putumayo but are absent in Nariño.

Regarding fuel types, propane gas is the most frequently used (89.2% overall), followed by firewood from household harvests (65%) and gasoline or diesel (53%). Regional variation shows that firewood is used more in Nariño (67%) than in Putumayo (53%). Gasoline or diesel use is higher in Putumayo (68%) compared to Nariño (50%), while collected firewood is more common in Putumayo (40%) than Nariño (22%).

These results highlight opportunities to improve waste management and promote sustainable energy alternatives, such as expanding biogas systems and increasing the adoption of renewable energy sources like solar panels, to support environmental sustainability and enhance rural livelihoods.

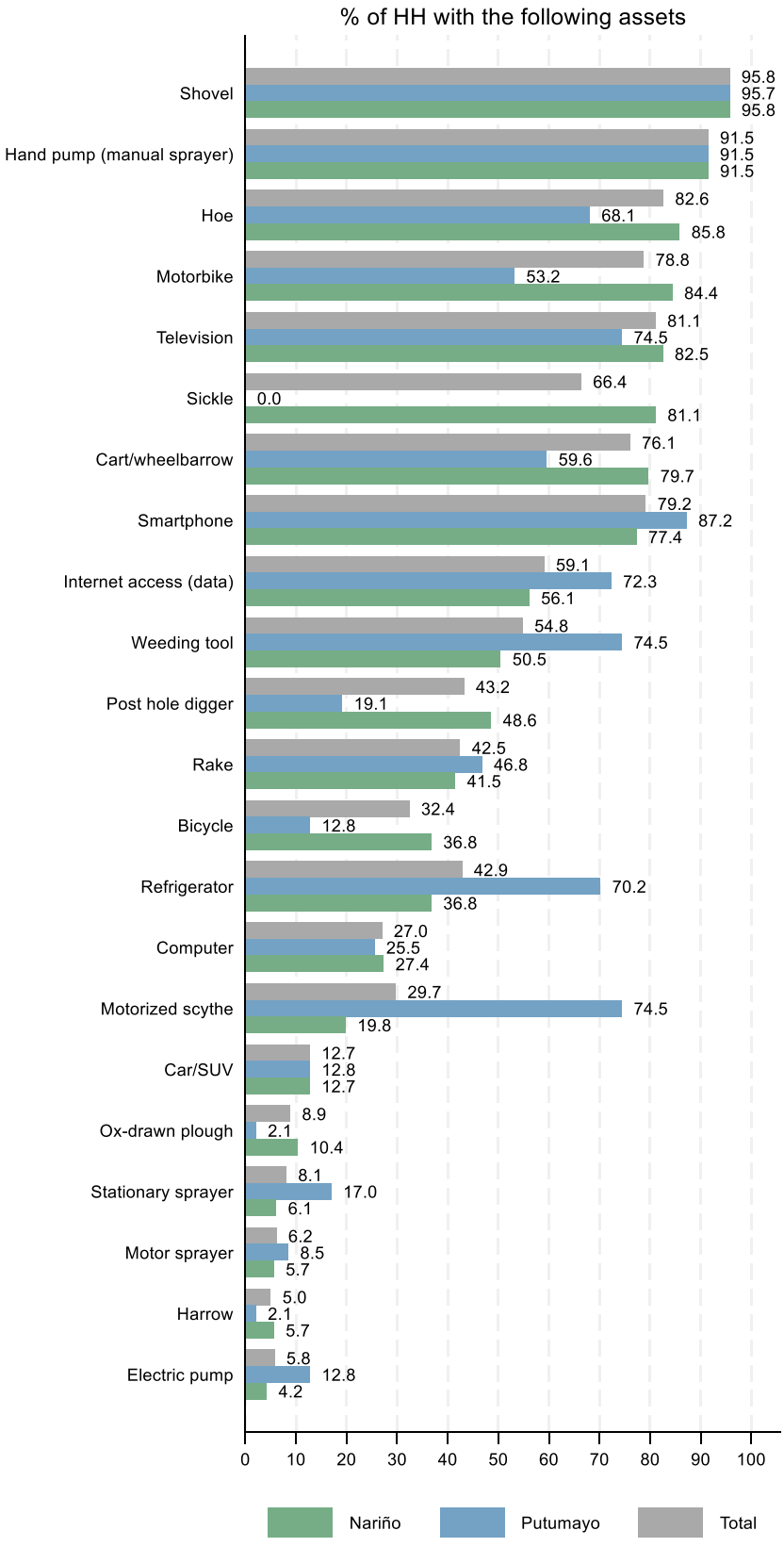
3.3.6 Household assets

Figure 7 illustrates the percentage of household ownership of assets, highlighting some key trends and regional differences. The data indicates that basic productive tools such as shovels (96%), hand pumps (92%), and hoes (83%) are widely owned across households, reflecting the widespread use of basic manual tools across all households, underscoring their essential role in agricultural activities. Other commonly owned tools include carts/wheelbarrows (76%) and sickles (66%), while advanced agricultural equipment like motorized scythes (30%) and motor sprayers (6%) are less prevalent, indicating limited mechanization overall. Regarding household assets, overall data show that televisions (81%) and smartphones (79%) are the most widely owned, followed closely by motorbikes (79%). However, items such as computers and bicycles are less common

While there are similarities in asset ownership across regions, notable differences exist. In Putumayo, households exhibit significantly higher ownership of refrigerators, internet access, and motorized scythes, indicating a focus on

connectivity and agricultural efficiency. Conversely, households in Nariño show higher ownership of motorbikes, sickles, and carts/wheelbarrows.

Figure 7. Household assets by department



Source: Authors' elaboration

3.3.7 Social capital

Regarding social capital, belonging to any group or association has overall 78% of households belong to at least one association, with a markedly higher proportion in Putumayo (96%) compared to Nariño (74%). been used as proxy. Among specific types of associations, membership in producers' associations is the most common (69% overall), with significantly higher participation in Putumayo (92%) compared to Nariño (64%). Community organizations, such as councils or women's associations, is the second most common type of membership, that also exhibit greater membership in Putumayo (30%) than in Nariño (12%). Other types of associations, such as cooperatives and agro-tourism organizations, show minimal overall participation.

In terms of technical assistance for agricultural activities, 53% of households report receiving support, with a substantial gap between Putumayo (80%) and Nariño (46%), resulting in a statistically significant difference. The main topics of training or technical assistance vary slightly by region. Good agricultural practices are the most common focus (36% overall), with a higher prevalence in Putumayo (48%) compared to Nariño (31%). Other areas of training, such as management or conservation of agrobiodiversity (18%), soil management (8%), and natural resource management (4%), show regional differences but with lower overall participation. Notably, topics like good livestock practices, associativity, and good milking practices are more common in Nariño, whereas they are negligible or absent in Putumayo.

Table 13. Association membership

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Households that belong to any association (%)	**77.6%**	**73.6%**	**95.7%**	**-22.2%*** **
Cooperative	0.4%	0.0%	2.1%	
Producers' Association	68.7%	63.7%	91.5%	-27.8%**
Community Organization (community council, women's association or organization, ethnic, youth)	15.1%	11.8%	29.8%	-18.0%***
Agro-tourism Organization	2.7%	2.8%	2.1%	0.7%
Households that received technical assistance or advice for the development of their agricultural activities	**53.2%**	**45.5%**	**80.0%**	**-34.5%**
Main topics on which training/technical assistance was received (%)	**64.5%**	**67.00%**	**53.2%**	**13.8%***
Good agricultural practices	36.0%	30.6%	47.5%	-16.9%
Management or conservation of agrobiodiversity	17.6%	15.3%	22.5%	-7.2%
Soil management/soil conservation	8.0%	4.7%	15.0%	-10.3%
Good livestock practices	6.4%	9.4%	0.0%	
Natural resource management	4.0%	4.7%	2.5%	2.2%
Associativity	3.2%	4.7%	0.0%	
Good milking practices	3.2%	4.7%	0.0%	
Marketing	3.2%	3.5%	2.5%	1.0%

Source: Authors' elaboration

Note: Asterisks represent the statistical significance level of the chi-square test for proportion differences. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Tests were conducted at a 95% confidence level.

These results underscore the regional differences in associativity and access to technical assistance, with Putumayo households demonstrating higher involvement in associations and greater access to technical support, particularly in areas like good agricultural practices. In contrast, Nariño households exhibit lower overall participation, but topics of technical assistance are more varied.

4. Community survey

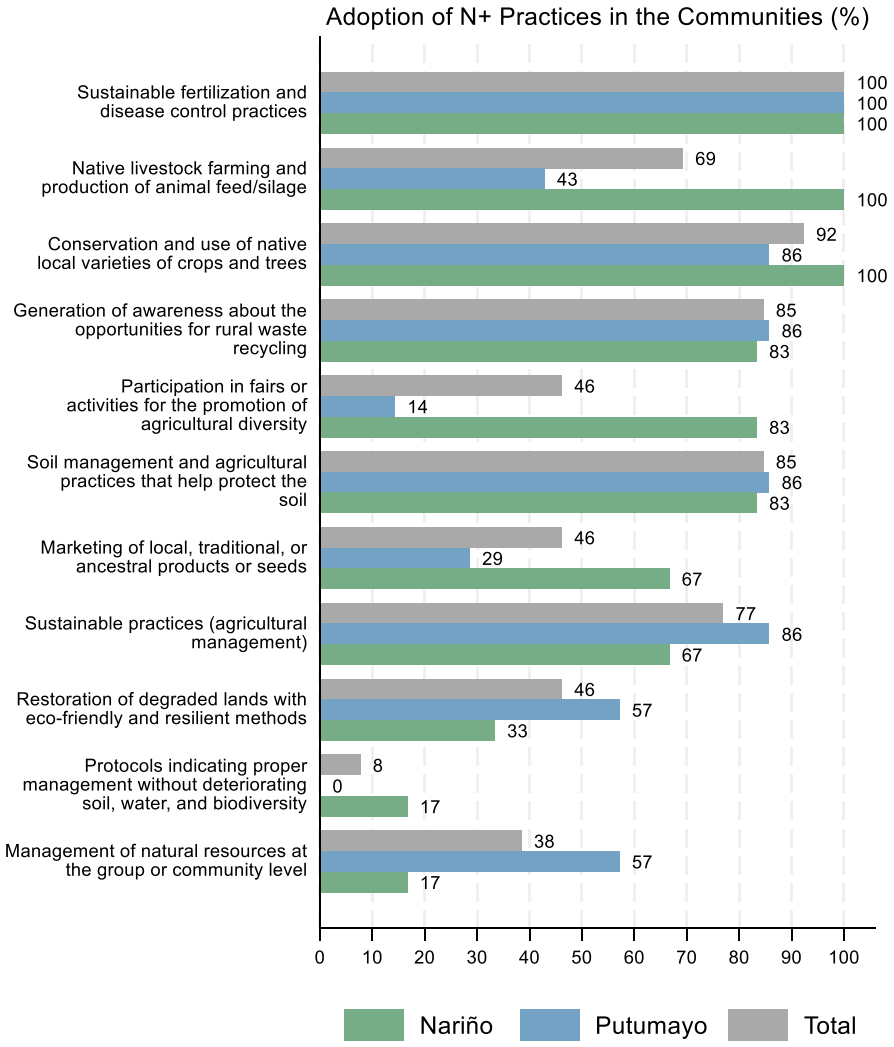
The community survey aimed to gather key information from the perspective of key informants (KII) about the communities visited during the household data collection process. A total of 15 KII interviews were conducted in both regions, 7 in Nariño and 8 in Putumayo. In the case of Nariño, most of the KII were councilors/alderman and members of the Community Action Boards (JAC). In Colombia, JAC refers to civic, social, and community organizations established to work towards developing their communities. In the case of Putumayo, most of the interviews were conducted with JAC members and lead producers (Table 14). Results regarding the general characteristics of communities are presented in Annex Table A4. Concerning NPS practices.

Table 14. Key informant interviews (KII) distribution

KII Type	(1) Nariño	(2) Putumayo
Governor of the Indigenous Council	0	1
Councilor /Alderman	5	0
Member of the Community Action Board (JAC)	2	4
Lead Producer	0	2
Other	1	0

Source: Authors' elaboration

Figure 8. Adoption of NATURE+ practices in communities



Source: Authors' elaboration

* The practice "Production of biofuels" is not reported in any community.

Figure 8 illustrates the results of the Key Informant Interviews (KII) on the perception of producers in the village implementing NPS practices or actions. Although the order of practices differs compared to household-level results, when the information is weighted by the percentage of farmers implementing the practices (annex Table A5), and the perceived importance level of each practice (Table 15), it aligns closely with household-level findings. These results indicate that the conservation and use of local native varieties of crops and trees, as well as soil management and agricultural practices that help protect the soil, are considered the most important and widely used practices. Additional details about the perceived benefits of NPS practices and regional differences are provided in the annex section.

Table 15.Community leader's perception on the importance of NATURE+ practices

Nature+ practices (indicator)	Not important	Less important	Important	Very important
Conservation and use of local native varieties of crops and trees	0.0%	7.7%	7.7%	84.6%
Native livestock farming and animal feed/silage production	7.69%	7.7%	38.5%	46.2%
Soil management and agricultural practices that help protect the soil	0.0%	0.0%	30.8%	69.2%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	0.0%	0.0%	46.2%	53.9%
Sustainable fertilization and disease control practices	0.0%	0.0%	15.4%	84.6%
Production of biofuels	0.0%	46.2%	46.2%	7.7%
Participation in fairs or activities to promote agricultural diversity	0.0%	23.1%	15.4%	61.5%
Marketing of local, traditional or ancestral products or seeds	0.0%	7.7%	30.8%	61.5%
Management of natural resources at the group or community level	0.0%	7.7%	61.5%	30.8%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	23.1%	46.2%	30.8%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	15.4%	46.2%	38.5%
Generation of awareness about the opportunities of rural waste recycling	0.0%	15.4%	15.4%	69.2%

Source: Authors' elaboration

5. Conclusion

The report highlights the findings of the monitoring survey conducted in 2024 as part of the NATURE+ project in Colombia. The study covered two main agroecological zones: the highlands of Nariño (Cumbal municipality) and the lowlands of Putumayo (Puerto Guzmán, Mocoa, and Villagarzón municipalities). The results provide a comprehensive understanding of the socioeconomic and agricultural conditions in Nariño and Putumayo, highlighting the distinct characteristics and challenges of these regions. These differences are reflected in dietary diversity, agricultural inputs, production methods, and the adoption of sustainable practices, which are influenced by cultural, ecological, and economic factors.

Nariño and Putumayo exhibit distinct socio-economic and demographic characteristics that reflect their unique regional contexts. Nariño, with a predominantly indigenous population, faces challenges such as lower educational attainment, with only 16% of household heads completing secondary education and 3% achieving tertiary education, alongside a higher prevalence of female-headed households (26%) and a lower dependency ratio (0.12). In contrast, Putumayo shows higher educational achievement, with 30% of household heads completing secondary education and 17% attaining tertiary education. Female-headed households are less common (17%), but they show a higher dependency ratio (0.24), indicating greater caregiving responsibilities.

Household income and living standards exhibit some regional contrasts. While living standards, captured by the durable asset index, is very similar between regions (0.6 in both regions), Nariño leads in vehicle ownership (88% vs. 64%). Conversely, households in Putumayo show higher smartphone ownership (87% vs. 77%), likely due to better network coverage. Households in Putumayo report higher agricultural incomes (6.4 million COP annually) than those in Nariño (2.1 million COP), driven by differences in crop types and market integration.

Food security also differs significantly, with households in Nariño consuming a significantly higher number of food groups and showing a more diverse diets due to greater consumption of vegetables, fruits, and dairy products (9.4 out of 12 food groups), while those in Putumayo facing greater food insecurity and a less varied diet (8.5 out of 12 food groups). On the other hand, food insecurity seems to be a pressing issue, with about 20% of households experiencing moderate to severe food insecurity. The prevalence of severe food insecurity is about 1%, a value in line with national statistics from Colombia. However, results also highlight regional disparities in food security experiences. Households in Putumayo show higher vulnerability compared to those in Nariño, with a higher prevalence of households reporting being worried about food access (47% vs. 35%), unhealthy diets (43% vs. 23%), insufficient food quantity (51% vs. 29%), and reduced portions (43% vs.16%). These findings align with Putumayo's lower dietary diversity and greater reliance on staples, highlighting barriers to accessing a varied and sufficient diet, while chagras in Nariño's provide a diverse range of nutrient-rich foods, contributing to better food security compared to the former region.

Results reveal also stark regional disparities in land ownership and agricultural practices between Nariño and Putumayo. In Nariño, the average parcel size is significantly smaller (0.9 hectares) than in Putumayo (11 hectares). This contrast reflects differing land uses: Nariño's agricultural system revolves around small, diversified plots known as chagras, which integrate traditional Andean crops such as potatoes, ulluco, and oca, vital for food security and cultural preservation. In contrast, Putumayo's larger landholdings facilitate extensive tropical agroforestry systems, supporting crops such as cacao, cassava, and peach palm (*chontaduro*).

Soil erosion affects 17% of households, with Putumayo experiencing a higher prevalence (28%) than Nariño (15%). However, households in Nariño are more proactive in adopting erosion control measures, (87% vs. 54%), such as crop rotation, minimum tillage, and vegetative cover. These practices reflect the influence of Indigenous views that emphasize harmony with nature. Trees cultivation (agroforestry or tree crops) is prominent in both regions, with 89% of households incorporating trees into their agricultural systems. Nariño primarily uses trees for energy and medicinal purposes, while Putumayo leverages them for fruit, commercial purposes, and subsistence consumption.

This result indicates a contrast between subsistence-oriented practices in Nariño and income-generating strategies in Putumayo.

Native/traditional perennial crop seeds are widely used by farmers in both zones, with an overall usage rate of 83%. This rate is slightly higher in Putumayo (94%) than in Nariño (80%), indicating a strong preference for traditional varieties. In contrast, the perceived use of improved seeds is significantly higher in Putumayo (89%) compared to Nariño (33%). This disparity can be attributed to the types of crops predominant in each region. In Putumayo improved seeds are commonly associated with cacao, plantain, and fruit trees, while in Nariño improved seeds are more frequently linked to forage crops and fruit trees that are less common given the predominant potato and Andean root tubers cultivation. In annual cropping systems, the use of native seeds remains high, with an overall usage rate of 91%. Disaggregating the data by region reveals that native seed use is overwhelmingly prevalent in Nariño (99%) compared to Putumayo (60%). This stark difference underscores the cultural and ecological importance of traditional varieties in Nariño. Conversely, the perceived use of improved seeds for annual crops is higher in Nariño (45%) than in Putumayo (17%). The lower adoption rate in Putumayo can be explained by the prevalence of crops such as cassava, maize, and beans, which are primarily grown for food security. For these crops, farmers tend to plant local landraces that are better adapted to the region's conditions and cultural preferences.

Organic fertilizers are widely adopted in both regions, especially in Nariño where traditional practices dominate. Inorganic fertilizers are used less frequently but are more common in Nariño than in Putumayo, reflecting the intensive cultivation of annual crops in the highlands versus the extensive systems in the lowlands. Pesticide use is higher in Nariño, reflecting a potential greater pest pressure.

Self-reported adoption of NATURE+ related practices is relatively high in both regions, especially for conservation of soil, and use of native crops and tree varieties. While households in Putumayo exhibit higher adoption rates of sustainable practices, those in Nariño report a more consistent adoption over time. Gender roles also shape agricultural activities, with women predominantly leading marketing and recycling tasks and men focusing more on technical and agricultural production work. Joint decision-making remains common throughout most activities.

The production landscape reflects regional crop preferences: households in Nariño favor Andean crops such as potatoes, oca, and *ulluco*, while Putumayo is dominated by tropical staples like cassava, cacao, and *chontaduro*. Despite crop yields being generally low compared to national averages, cassava and maize productivity in Putumayo stands out. Market participation is high in both regions, with Nariño excelling in dairy sales and Putumayo in livestock sales. Additionally, waste management practices show a strong reintegration of organic waste into the soil, although the incineration of plastic and paper waste remains prevalent. Public electricity is the main energy source in both regions, supplemented by higher prevalence of use of solar panels in Putumayo.

Social capital is higher in Putumayo, witnessed by greater participation in producer associations and better access to technical assistance. In both regions community leaders' perceptions align with household-level findings, emphasizing the importance of native varieties conservation and effective soil management.

The report reveals that while Nariño show advantages in community-based, traditional agricultural practices and higher dietary diversity, Putumayo excels in market-oriented production and adoption of sustainable land-use practices. However, both regions face challenges, including limited crop productivity -relative to national average- and regional disparities in access to agricultural resources and markets, highlighting the necessity of tailored interventions to address regional challenges and capitalize on local strengths. These findings lay a strong foundation for designing region-specific strategies that promote resilient and sustainable agricultural systems.

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Appendix

Table A1 Household Waste Management

Indicator	(1) Overall	(2) Nariño	(3) Putumayo	(4) Diff (2)-(3)
Amount produced (in kg) per year.				
Livestock manure	3133.9	1352.9	15304.167	-13951.2***
Livestock remains from slaughter	59.3	59.3	0	
Crop residues	862.4	862.4	0	
Plastic waste	40.7	47.5	21.6	25.9
Paper/cardboard waste	18.7	17.5	50	-32.5
Glass, cans, tin	9.9	8.9	16	-7.1
Other inorganic waste	20.5	4.4	43	-38.6

Source: Author's elaboration

Table A2 Positions held by respondents of the community survey

Indicator	(1) Overall	(2) Nariño	(3) Putumayo
positions/roles held (%)			
Member of the Junta de *acción comunal* (Community Action Board)	40.0%	25.0%	57.1%
Leading producer	13.3%	0.0%	28.6%
Governor of the Cabildo	6.7%	0.0%	14.3%
Alderman	33.3%	62.5%	0.0%
Lieutenant	6.7%	12.5%	0.0%

Source: Author's elaboration

Note: *In total, the number of respondents from the 13 communities is 15, with 8 in Nariño and 7 in Putumayo. In both Cuaical and Tasmag, there are 2 respondents each

Table A3 NPS Practices: individual and grouped categories

New Category	Practice Name	Description
Conservation and use of Agrobiodiversity	Conservation, recovery, and cultivation of local crop varieties	
	Cultivation of local varieties of trees (e.g., mango varieties)	
	Community seed banks	
	Production of seeds or seedlings of native trees or local varieties	
	Cultivation of native trees for purposes other than production	
	Participatory Varietal Selection (PVS) from native or locally adapted species (to select the preferred variety based on taste, yield, etc.)	
	Participatory Plant Breeding (PPB) from native or locally adapted species	
	Use of wild endemic herbs / nutritious leafy vegetables	
Native livestock and production of food/silage for animals	Participatory improvement of native livestock	
	Conservation of native livestock	
	Production of animal feed	
	Silage production	
Soil management and conservation practices	Application of agroecology principles to improve soil fertility and phytosanitary management	
	Intercropping / crop rotation	
	Cover crops	
	Minimum or zero tillage	
	Protection or assistance for the natural regeneration of vegetation	
	Use of live barriers and contour lines to control erosion	
	Use of dikes, terraces, and trenches to reduce runoff and erosion and facilitate infiltration	
Sustainable practices for water resource management	Use of protective strips around rivers or streams	
	Wastewater treatment for irrigation	
	Use of ponds to store water	
	Use of artificial wetlands for the treatment and reuse of wastewater	
Sustainable practices for fertilization and disease control	Use of classical biocontrol (introduction of natural enemies)	Sustainable practices, they are agricultural management practices that do not harm the environment, so respectful of nature. Examples are very low use of inorganic fertilizers, use of manure, leaving crop residue on the field, minimum tillage, and similar practices that increase biomass and soil moisture without negative impacts on the environment.
	Use of flower strips or live barriers around fields to attract beneficial insects (e.g., pollinators, natural enemies)	
	Use of other biocontrol measures	
	Reduction/elimination of chemical pesticides	
	Reduction/elimination of prophylactic spraying	
	Use of selective pesticides (as opposed to broad-spectrum ones)	
	Use of biological pesticides (or other non-chemical ones)	
	Use of cultural pest management practices (e.g., rotation, intercropping, changes in planting dates, etc.)	

	Use of habitat conservation practices to improve natural pest control	
	Manure fertilization	
	Compost production	
Biofuel production	Biochar production	
	Biogas production	
	Briquette production	
Participation in spaces promoting agrobiodiversity	Participation in a seed guardians organization	
	Participation in seed fairs	
	Participation in an organization for the conservation of arboreal agrobiodiversity	
	Participation in tree diversity fairs (Sharing seedlings or reproductive material)	
	Participation in diversity parks	
Commercialization of local or traditional/ancestral products or seeds	Sale or exchange of seeds or seedlings of native trees or local varieties	
	Sale of local/minor crops and neglected and underutilized species (NUS) to niche markets	
	Production and sale of consumer products (bags, banks, mango seed oil)	
Commons management	Commons management	Commons management, is management of natural resources at the group or community level
Integrated protocols for soil, water, and biodiversity	Categories coming from monitoring indicators	Integrated soil, water, biodiversity protocols refer to those protocols that discipline the correct and sustainable management of soil, water, and biodiversity
Cost-effective and climate-resilient restoration of degraded lands	Categories coming from monitoring indicators	Cost effective and climate resilient restoration of degraded lands refers to restoration of degraded (polluted) lands with low-cost interventions that do not harm the environment and withstand climate events (such as drought- or heat-tolerant crop varieties)
Community awareness about rural waste recycling opportunities	Categories coming from monitoring indicators	Projects in the communities to raise the knowledge of the importance of recycling waste.

Table A4 General characteristics of the communities

Indicator	(1) Overall	(2) Nariño	(3) Putumayo
Estimation of community leaders in:			
Number of households	365	688	88
Total population (#)	1514	2950	283
Female population (%)	45.6%	44.2%	46.8%
Youth population, ages 14-28 (%)	25.9%	21.3%	29.9%
Population of farmers, agricultural or livestock (%)	52.6%	75.8%	32.7%
Communities where the main activity is (%):			
Agriculture	69.2%	50.0%	85.7%
Wood extraction	7.7%	0.0%	14.3%
Livestock	23.1%	50.0%	0.0%
Communities where the main crop is (%):			
Açaí	7.7%	0.0%	14.3%
Cocoa	15.4%	0.0%	28.6%
Peach-palm	7.7%	0.0%	14.3%
Potato	46.2%	100.0%	0.0%
Plantain	15.4%	0.0%	28.6%
Cassava	7.7%	0.0%	14.3%
Communities that implement improved seeds (%)	76.9%	83.3%	71.4%
Estimated percentage (by the leaders) of producers who implement improved seeds within their community	29%	19%	39%
From what source do farmers in the community usually obtain these improved seeds?			
Other farmers in the community	38.5%	66.7%	14.3%
Provided by an NGO or project	30.8%	33.3%	28.6%
Association of Producers in the community	23.1%	16.7%	28.6%
Purchased at the agricultural supply store in the community	7.7%	16.7%	0.0%
Purchased from sellers of agricultural supply commercial houses	7.7%	0.0%	14.3%
Purchased at fair/market	7.7%	16.7%	0.0%
From what source do farmers in the community usually obtain these traditional/creole seeds? [1]			
Farmers' chagra/plot	46.2%	66.7%	28.6%
Saved from the harvest	46.2%	50.0%	42.9%
Other farmers in the community	53.8%	33.3%	71.4%
% of communities that have perceived a reduction in the availability of traditional or creole seed varieties in the last 5 years	76.9%	83.3%	71.4%
% of communities that have groups or programs in the community that promote native cooking or recipes with traditional foods	23.1%	50.0%	0.0%
% of communities that have groups or programs in the community that lead the restoration of degraded lands in a profitable and climate-resilient manner	46.2%	50.0%	42.9%
Number of communities	**13**	**6**	**7**

Source: Author's elaboration

Note: [1]None of the communities have schools with an agricultural focus. The closest market for selling agricultural products for 13 of the communities is in the municipal center, while the remaining community has its market situated in another municipality.

Table A5 General information about NATURE+ practices in the communities

Nature+ practices (indicator)	(1) Overall	(2) Nariño	(3) Putumayo
Producers in the village estimated by the leader to engage in the practice (%)			
Conservation and use of local native varieties of crops and trees	54.0%	42.2%	65.8%
Native livestock farming and animal feed/silage production	40.7%	44.2%	33.7%
Soil management and agricultural practices that help protect the soil	69.5%	70.0%	69.2%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	67.0%	77.5%	60.0%
Sustainable fertilization and disease control practices	55.8%	53.3%	57.9%
Participation in fairs or activities to promote agricultural diversity	42.5%	45.0%	30.0%
Marketing of local, traditional or ancestral products or seeds	50.8%	31.3%	90.0%
Management of natural resources at the group or community level	46.0%	10.0%	55.0%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	50.0%	50.0%	0.0%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	35.3%	21.0%	42.5%
Production of biofuels	0.0%	0.0%	0.0%
Generation of awareness about the opportunities of rural waste recycling	58.2%	64.0%	53.3%
Communities where there are currently initiatives or projects related to (%):			
Conservation and use of local native varieties of crops and trees	69.2%	50.0%	85.7%
Native livestock farming and animal feed/silage production	23.1%	33.3%	14.3%
Soil management and agricultural practices that help protect the soil	38.5%	16.7%	57.1%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	30.8%	33.3%	28.6%
Sustainable fertilization and disease control practices	38.5%	16.7%	57.1%
Production of biofuels	0.0%	0.0%	0.0%
Participation in fairs or activities to promote agricultural diversity	38.5%	66.7%	14.3%
Marketing of local, traditional or ancestral products or seeds	23.1%	33.3%	14.3%
Management of natural resources at the group or community level	23.1%	16.7%	28.6%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	0.0%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	7.7%	0.0%	14.3%
Generation of awareness about the opportunities for rural waste recycling	30.8%	16.7%	42.9%
Communities where, in collaboration with NGOs or Extension Agencies, activities related to have been developed (%):			
Conservation and use of local native varieties of crops and trees	33.3%	33.3%	33.3%
Native livestock farming and animal feed/silage production	66.7%	100.0%	0.0%
Soil management and agricultural practices that help protect the soil	60.0%	0.0%	75.0%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	50.0%	0.0%	100.0%
Sustainable fertilization and disease control practices	80.0%	0.0%	100.0%
Production of biofuels	0.0%	0.0%	
Participation in fairs or activities to promote agricultural diversity	40.0%	25.0%	100.0%
Marketing of local, traditional or ancestral products or seeds	0.0%	0.0%	0.0%
Management of natural resources at the group or community level	0.0%	0.0%	0.0%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	100.0%	0.0%	100.0%
Generation of awareness about the opportunities for rural waste recycling	50.0%	0.0%	66.7%
Number of communities	**13**	**6**	**7**

Source: Author's elaboration

Table A 6: Benefits of Nature positive practices implementation: Community Leader's perception (OVERALL RESULTS)

Nature+ practices (indicator)	Increase in productivity	Reduction in production costs	Labor savings	Decrease in workload	Improvement in production quality	Improvement in soil properties	Less pollution	Better resistance to climatic factors	Higher income	Prevents erosion and conserves moisture	None	Does not know	Other
Conservation and use of local native varieties of crops and trees	0.0%	7.7%	0.0%	0.0%	0.0%	0.0%	23.1%	23.1%	7.7%	23.1%	0.0%	0.0%	7.7%
Native livestock farming and animal feed/silage production	0.0%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	7.7%	7.7%	0.0%	0.0%	0.0%	0.0%
Soil management and agricultural practices that help protect the soil	0.0%	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	30.8%	15.4%	15.4%	0.0%	0.0%	0.0%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.8%	38.5%	0.0%	30.8%	0.0%	0.0%	0.0%
Sustainable fertilization and disease control practices	0.0%	23.1%	0.0%	7.7%	0.0%	0.0%	7.7%	0.0%	0.0%	23.1%	0.0%	0.0%	0.0%
Production of biofuels	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Participation in fairs or activities to promote agricultural diversity	0.0%	0.0%	0.0%	15.4%	0.0%	0.0%	7.7%	0.0%	30.8%	0.0%	0.0%	0.0%	0.0%
Marketing of local, traditional or ancestral products or seeds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.7%	7.7%	15.4%	0.0%	0.0%	0.0%	15.4%
Management of natural resources at the group or community level	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.7%	7.7%	0.0%	7.7%	7.7%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.4%	0.0%	7.7%	0.0%	0.0%	0.0%
Generating awareness about the opportunities of rural waste recycling	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	76.9%	30.8%	23.1%	0.0%	0.0%	0.0%	0.0%

Source: Author's elaboration

Table A 7: Benefits of Nature positive practices implementation: Community Leader's perception (RESULTS FOR NARIÑO)

Nature+ practices (indicator)	Increase in productivity	Reduction in production costs	Labor savings	Decrease in workload	Improvement in production quality	Improvement in soil properties	Less pollution	Better resistance to climatic factors	Higher income	Prevents erosion and conserves moisture	None	Does not know	Other
Conservation and use of local native varieties of crops and trees	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	16.7%	50.0%	16.7%	0.0%	0.0%	0.0%	0.0%
Native livestock farming and animal feed/silage production	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%
Soil management and agricultural practices that help protect the soil	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	66.7%	33.3%	16.7%	0.0%	0.0%	0.0%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	33.3%	0.0%	33.3%	0.0%	0.0%	0.0%
Sustainable fertilization and disease control practices	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%
Production of biofuels	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Participation in fairs or activities to promote agricultural diversity	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	16.7%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%
Marketing of local, traditional or ancestral products or seeds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	16.7%	33.3%	0.0%	0.0%	0.0%	0.0%
Management of natural resources at the group or community level	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.7%	0.0%	16.7%	0.0%	0.0%	0.0%
Generating awareness about the opportunities of rural waste recycling	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.3%	50.0%	33.3%	0.0%	0.0%	0.0%	0.0%

Source: Author's elaboration

Table A8 Benefits of Nature positive practices implementation: Community Leader's perception (RESULTS FOR PUTUMAYO)

Nature+ practices (indicator)	Increase in productivity	Reduction in production costs	Labor savings	Decrease in workload	Improvement in production quality	Improvement in soil properties	Less pollution	Better resistance to climatic factors	Higher income	Prevents erosion and conserves moisture	None	Does not know	Other
Conservation and use of local native varieties of crops and trees	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	28.6%	0.0%	0.0%	42.9%	0.0%	0.0%	14.3%
Native livestock farming and animal feed/silage production	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Soil management and agricultural practices that help protect the soil	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	42.9%	0.0%	28.6%	0.0%	0.0%	0.0%
Sustainable fertilization and disease control practices	0.0%	28.6%	0.0%	14.3%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Production of biofuels	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Participation in fairs or activities to promote agricultural diversity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%
Marketing of local, traditional or ancestral products or seeds	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	28.6%
Management of natural resources at the group or community level	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	14.3%	0.0%	14.3%	14.3%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Generating awareness about the opportunities of rural waste recycling	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	71.4%	14.3%	14.3%	0.0%	0.0%	0.0%	0.0%

Source: Author's elaboration

Table A9 Community Leader's Perception on the Importance of NATURE+ Practices (RESULTS FOR NARIÑO)

Nature+ practices (indicator)	Not important	Less important	Important	Very important
Conservation and use of local native varieties of crops and trees	0.0%	0.0%	0.0%	100.0%
Native livestock farming and animal feed/silage production	0.0%	0.0%	16.7%	83.3%
Soil management and agricultural practices that help protect the soil	0.0%	0.0%	33.3%	66.7%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	0.0%	0.0%	33.3%	66.7%
Sustainable fertilization and disease control practices	0.0%	0.0%	0.0%	100.0%
Production of biofuels	0.0%	33.3%	66.7%	0.0%
Participation in fairs or activities to promote agricultural diversity	0.0%	0.0%	16.7%	83.3%
Marketing of local, traditional or ancestral products or seeds	0.0%	0.0%	33.3%	66.7%
Management of natural resources at the group or community level	0.0%	0.0%	83.3%	16.7%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	0.0%	83.3%	16.7%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	0.0%	66.7%	33.3%
Generation of awareness about the opportunities of rural waste recycling	0.0%	0.0%	16.7%	83.3%

Source: Author's elaboration

Table A10 Community Leader's Perception on the Importance of NATURE+ Practices (RESULTS FOR PUTUMAYO)

Nature+ practices (indicator)	Not important	Less important	Important	Very important
Conservation and use of local native varieties of crops and trees	0.0%	14.3%	14.3%	71.4%
Native livestock farming and animal feed/silage production	14.3%	14.3%	57.1%	14.3%
Soil management and agricultural practices that help protect the soil	0.0%	0.0%	28.6%	71.4%
Sustainable practices (agricultural management that does not harm the environment, so are respectful of nature) for water resources management	0.0%	0.0%	57.1%	42.9%
Sustainable fertilization and disease control practices	0.0%	0.0%	28.6%	71.4%
Production of biofuels	0.0%	57.1%	28.6%	14.3%
Participation in fairs or activities to promote agricultural diversity	0.0%	42.9%	14.3%	42.9%
Marketing of local, traditional or ancestral products or seeds	0.0%	14.3%	28.6%	57.1%
Management of natural resources at the group or community level	0.0%	14.3%	42.9%	42.9%
Protocols that indicate correct management without deteriorating soil, water and biodiversity	0.0%	42.9%	14.3%	42.9%
Restoration of degraded (contaminated) lands with low-cost interventions that do not harm the environment and are resistant to climate events (such as drought- or heat-tolerant crop varieties)	0.0%	28.6%	28.6%	42.9%
Generation of awareness about the opportunities of rural waste recycling	0.0%	28.6%	14.3%	57.1%

Source: Author's elaboration

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