POLICY BRIEF

Adoption of sustainable cattle practices in Olancho, Honduras: A path to climate resilience

Summary

This study examines adoption of sustainable cattle practices in Olancho, Honduras. Surveying 425 producers participating in Heifer International Farmer Field Schools (FFS), we found moderate rates of adoption, suggesting a gradual transition toward sustainable silvopastoral grazing systems. Uptake is strongest for "pasture-and-forage basics," led by improved pastures and live fences, with water troughs also widely used. Intermediate uptake includes paddock division, agroforestry areas, and early silvopastoral elements such as natural regeneration and planted trees. In contrast, more management-intensive and environmentally innovative practices—rotational grazing (conventional or intensive), waste management, biodigesters, and broader farm diversification—remain low, pointing to the next frontier for programming and policy. The study also used adoption profiles to capture how integrated management is at the pasture level, from isolated changes to bundled practice packages more likely to deliver productivity gains, drought buffering, and reduced pressure on land. Results show meaningful momentum, with many producers in middle tiers, alongside a sizable entry-stage segment where follow-up, enabling supports, and tailored incentives could accelerate progress. Adoption varies by gender, farm size, age, FFS participation, and community context. The study recommends targeted support for women, youth, and smallholders; stronger technical assistance and incentives; gender-inclusive policies; improved access to technology; and strengthened monitoring systems to scale sustainable practices.

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KEY MESSAGES

The sustainability challenge is urgent, but the pathway is clear. Olancho's extensive cattle model is environmentally costly; sustainable (silvopastoral) approaches can improve productivity while restoring key ecosystem services.

Adoption profiles make progress measurable and actionable. Tracking producers by levels (non-adopter > scattered > Levels 1–3) helps distinguish early uptake from deeper systems transition, identify where producers get "stuck," and monitor whether programs are moving households toward more resilient, integrated management over time.

Who adopts – and how far – depends on producer and place. Patterns vary by gender, age, farm size, and landscape, implying the need for tailored support rather than one-size-fits-all programming.

Context and challenges

Traditional cattle ranching in Olancho, Honduras exemplifies the environmental challenges of extensive cattle production systems. Characterized by low-input practices and monoculture pastures, this model has contributed significantly to deforestation (Calvin et al., 2016; Rehman, 2021), greenhouse gas emissions (Grossi et al., 2019; Graham et al., 2020; IPCC, 2019), and biodiversity loss (Alkemade et al., 2012). The region faces compounding pressures from rising global meat and milk demand (González-Quintero et al., 2022), which accelerates land conversion while degrading water and soil resources (Mora et al., 2017; Česonienė et al., 2019). This unsustainable trajectory underscores the urgent need for production systems that reconcile economic viability with ecological stewardship (Sandoval et al., 2023).

Persistent barriers hinder sustainability transitions in Olancho. Smallholder ranchers typically lack access to technical knowledge and financial resources (Mejia-Castillo, 2016), perpetuating low-productivity practices that drive further forest clearance for pasture expansion (Mejia-Castillo, 2016). In response, silvopastoral systems (SPS) and other sustainable cattle practices have emerged as a transformative alternative. By strategically integrating trees with cattle operations, SPS enhance land productivity while delivering critical ecosystem services including carbon sequestration, watershed protection, and habitat conservation (Lecegui et al., 2022). These integrated systems also improve climate resilience and income stability for producers (Brook et al., 2022; Contreras-Santos et al., 2021; Said Schettini et al., 2021; de Oliveira Resende et al., 2020).

Since 2020, Heifer International has supported Honduran cattle producers in Olancho through FFS, training them in sustainable practices and business skills. This study evaluates (1) participation levels in these trainings and (2) differences between adopters and non-adopters of sustainable practices, classifying them by implementation intensity. It also analyzes how farm size, gender, and age influence adoption. The findings will guide tailored strategies to improve engagement and scalability of SPS and other sustainable cattle practices in Olancho and similar Central American regions, enhancing both environmental sustainability and livelihoods. By identifying key adoption drivers, the research aims to optimize interventions for greater impact.

Methodology

This study was conducted in Olancho, Honduras, in October 2024, surveying 425 cattle producers (21.2% women) across four municipalities: Catacamas (134), Dulce (62), Juticalpa (92), and San Esteban (137). Producers were selected using simple random sampling based on participants in Heifer International's FFS.

In addition to examining which kinds of practices were most adopted, we used the adoption profiles, defined following Castro-Núñez et al. (2024), which classifies producers based on the number and combination of sustainable livestock practices implemented at the pasture/plot (potrero) level. Instead of treating adoption as "yes/no," the adoption levels turn a long list of practices into a practical, comparable measure of progress toward sustainable livestock systems.

This helps capture how integrated a producer's management has become – moving from no action to isolated changes to bundled practice packages that are more likely to deliver real outcomes (e.g., better forage availability, improved animal performance, stronger drought buffering, and reduced pressure on land).

The adoption profiles used in this study are as follows:

Non-adopter:

- A producer who does not implement any sustainable livestock practice.

Scattered adopter:

- A producer who applies only one practice – typically improved pastures – or a limited combination that does not represent integrated or intensive sustainable livestock management.

Level 1 adopter (basic):

- A producer who allows assisted or natural tree regeneration in pastures and combines this with either natural pasture or improved pasture.

Level 2 adopter (intermediate):

- A producer who has a forage bank or combines tree regeneration (assisted/natural) with a forage bank.

Level 3 adopter (advanced):

- A producer who implements any other combination of practices beyond the definitions above – indicating a more integrated sustainable livestock management approach.

To analyze whether rates of adoptions varied across production and producer characteristics, we used a univariate Logit adoption model. Independent variables were selected based on prior adoption literature and available survey characterization data and grouped as:

- Producer characteristics: age, education, gender
- Farm characteristics: farm area (ha), milk sales income (USD)
- Institutional/development factors: number of Farmer Field School modules (ECA), access to agroclimatic information, conservation agreement, area released from livestock production, access to Heifer promotores[1]
- Spatial controls: municipality.

Key findings

Household characteristics

Cattle producers surveyed generally exhibit similar household characteristics. On average, each household comprises 4.5 members. The average number of minors per household is 1.4, with Catacamas showing the highest proportion at 1.6. Women's on-farm roles are reported mainly in livestock management (about 55%) and crop management (about 36%), though a notable share of households report women do not participate in farm production. Livestock is the main income source for most households (over 70% in three municipalities, and closer to 60% in Dulce), with agriculture and other activities playing secondary roles.

Most households report high interaction with Heifer (around 40% "very high" on average) and about 81% report access to Heifer promotores, while participation in other non-Heifer projects varies widely (lowest in Dulce, highest in Juticalpa) as does membership in local information-sharing groups (very high in Dulce, very low in Juticalpa). Producers themselves are mostly men (about 78%), average around 42 years old, and primarily identify as livestock producers and smaller shares completing secondary and very few with technical/professional training.

Farm characteristics

The Olancho sample (n=425) is balanced between small and medium producers, with a smaller but important segment of large farms. Small farms (≤15 ha) represent 40% of households and have a median total farm size of 6.3 ha, a median herd size of 8 animals, and a median livestock area of 2 ha. Medium farms (15–<60 ha) also represent 40%, with a median farm size of 28 ha, a median herd of 20 animals, and a median livestock area of 14 ha – showing the large jump in both land and herd scale once households move beyond the smallest category. Large farms (≥60 ha) make up 22.4% and have much higher medians: 89 ha total area, 42 animals, and 56 ha in livestock, indicating substantially greater land devoted to cattle systems at the upper end of the distribution. The overall median for all producers is a medium farm with 28 ha total farm area, 20 animals, and 14 ha in livestock.

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[1]Typical Heifer FFS programing includes a farmer field school with 20 producers each, consisting of 8 modules delivered at monthly intervals. In addition, 1-2 producers are also trained up in additional agro-veterinarian techniques as community extensionists, called promotores to provide continued regular support in the region.

Participation in Heifer International's Farmer Field Schools

The training modules on milk quality (89%) and animal health (82%) had the highest engagement rates, while sustainable cattle practices showed notably low participation (8% on average). Municipalities like Juticalpa (3%) and San Esteban (5%) recorded particularly minimal involvement in training on sustainable cattle practices. Producers widely applied their Farmer Field School learnings to farm management. The most implemented modules included farm administration (94%), milk quality (93%), and animal health (94%). Dulce municipality reported the lowest adoption rates across all modules.

Sustainable cattle practices in the study area

Sustainable cattle practices implemented by the producers are illustrated in **Figure 1**. The most widely adopted practice is improved pasture, with 72% of producers implementing it, followed by live fences at 52%, and cattle water troughs at 41%. At the municipal level, Juticalpa stands out for the high percentage of producers using naturally regenerating trees (40%), intensive rotational grazing (29%), and forage banks (29%). In Catacamas, notable practices include tree planting (25%) and conventional rotational grazing (between 4 and 7 days) at 16%. In San Esteban, conventional rotational grazing is the most prominent practice, with 14% of producers adopting it. In Dulce, tree planting (17%) and line planting of trees in pastures (17%) are the most implemented practices.

Adoption levels of sustainable cattle practices in the study area

Adoption patterns show a progression from basic forage investments to more complex diversification and environmental management. High-adoption practices (>50%) are led by improved pastures (75%), confirming producers' priority to strengthen the forage base, followed by live fences (51%), which support production and landscape structure.

Intermediate adoption (15–50%) includes practices signaling gradual transition: water troughs (43%), paddock division (31%), and agroforestry areas (26%), alongside the presence of primary forest (24%) and recovering forest (22%). SPS elements are emerging through natural regeneration trees (27%) and planted trees (20%). Grazing remains mixed, with extensive grazing (41%) still common and deferred grazing (17%) less frequent.

Low-adoption practices (<15%) point to key opportunities: rotational grazing (14% conventional; 12% intensive), waste management (6%), and biodigesters (0.7%). Farm diversification is limited (home gardens ~6%; annual crops 9%; perennial crops 5%), reinforcing the dominant livestock focus. Overall, producers are strongest on forage and pasture basics, while intensification, diversification, and environmental innovations remain early-stage.

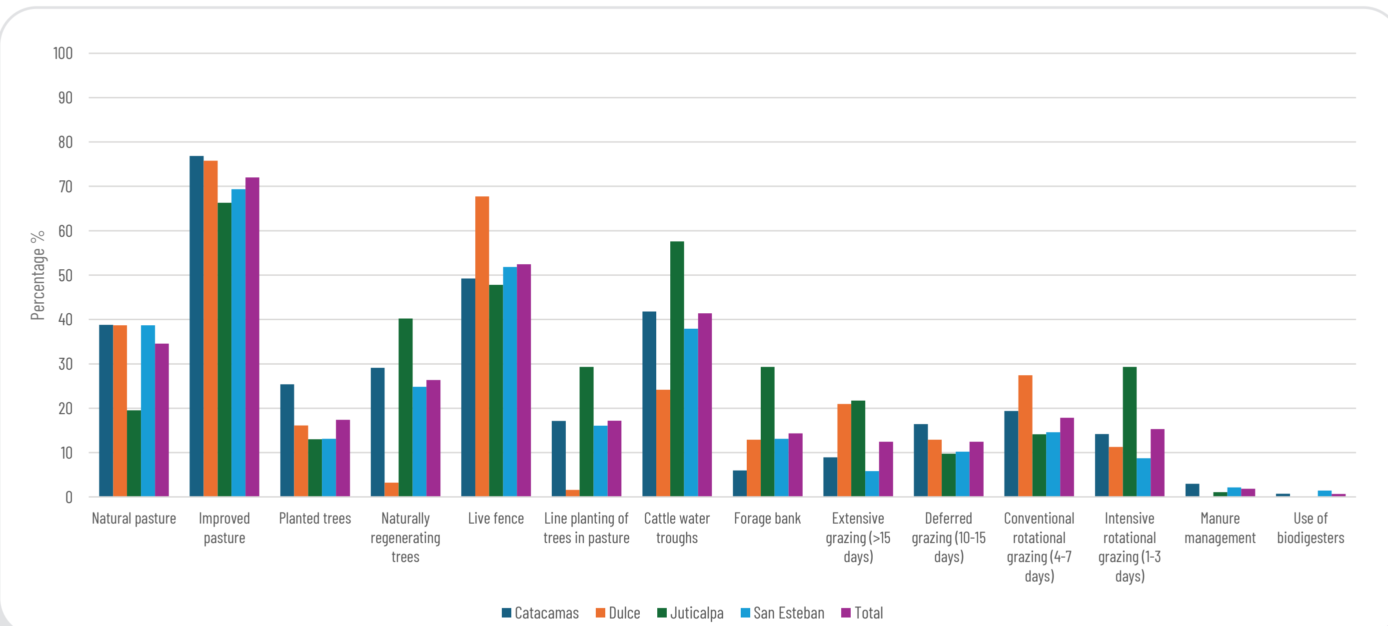

Figure 1 Percentage of producers implementing sustainable cattle practices by municipality.

Table 1 presents a breakdown of surveyed cattle producers analyzed by the classification level of adoption of the number and combination of sustainable practices applied on their plots/pastures as defined following Castro-Núñez et al. (2024).

Across the 425 producers surveyed, most producers were in the middle levels of adoption rather than at the extremes: In this sample, 57.4% of producers are implementing at least a basic package of practices (Levels 1–3), and 39.5% are in the more "integrated" tiers (Levels 2–3) that combine multiple measures more coherently (e.g., improved pastures and trees plus additional infrastructure such as forage banks). This suggests a meaningful base of momentum to build on, but also a sizeable segment still at "entry" stages (no adoption or scattered practice use) where design tweaks, follow-up, and enabling conditions could unlock progression.

Adoption patterns differ clearly by producer characteristics. *By sex*, women are more polarized: a higher share sits in non-adoption (30%) and a slightly higher share reaches Level 3 (14.4%), while fewer are found in the intermediate Levels 1–2 compared with men. Men show a more stepwise pattern, concentrating more heavily in Levels 1–2, which may reflect differences in access to training, land/livestock decision-making power, labor constraints, or risk tolerance (depending on context).

Farm size shows one of the strongest contrasts: small farms (<15 ha) are much more likely to reach Levels 2–3 (47.7%) than larger farms (≥15 ha: 26.7%), while larger farms have a much higher non-adoption rate (31.5%) – suggesting that scale does not automatically drive adoption and that larger operations may face different cost, labor, or management barriers.

By age, younger producers (<30) have the highest non-adoption (29.5%) rates, but among those who do adopt, a substantial share moves into Level 2, implying early barriers to starting but potential for rapid progress once engaged. Landscape matters as well: valleys show the highest share reaching Level 3, while upper zones concentrate in Level 1, consistent with places where initial adoption is feasible but moving into more complex, multi-practice packages may require stronger enabling support.

Participation in FFS is strongly linked to the adoption of sustainable practices. Producers who attended 3–5 FFS training sessions show the highest shares at Adoption Levels 2–3. In contrast, producers who attended <2 sessions are most often non-adopters (17%) or have only scattered practices (16%). Across basic, intermediate, and advanced adoption levels, the highest participation rates are consistently found among producers who attended >3 FFS sessions, highlighting FFS as a decisive training approach in the region.

Predicting adoptions rates from production characteristics

Adoption of sustainable cattle practices in Olancho is shaped less by farm size or income and more by information and institutional support. Access to agroclimatic information and Heifer promotores shows the strongest positive association with adoption, highlighting the importance of decision-relevant climate services and last-mile technical accompaniment. At the same time, adoption is uneven by place – with significantly lower probabilities in Dulce and San Esteban – and a gender gap persists, with women less likely to adopt under current conditions. These patterns point to actionable leverage points: improve climate-information delivery and interpretation, strengthen promotor coverage and continuity, and design targeted measures that reduce barriers for women and for municipalities facing structural constraints.

Table 1. Characterization of surveyed producers by adoption level.

Adoption profile	Total		Gender (%)		Farm size (%)		Age (%)		Participation in FFS (%)		
	#	%	Women	Men	<15ha	>=15ha	<30y	>=30y	<2 FFS	3 - 5 FFS	>=5 FFS
Non-adopter	88	20.7	30.7	69.3	40.9	59.1	37.5	62.5	17.0	44.3	38.6
Scattered adopter	93	21.9	25	80.7	64.8	40.9	23.7	76.3	16.1	45.2	38.7
Level 1 adopter (basic)	76	17.9	14.5	85.5	56.6	43.4	26.3	73.7	11.8	35.5	52.6
Level 2 adopter (intermediate)	116	27.3	14.7	85.3	72.4	27.6	24.1	75.9	8.6	53.4	37.9
Level 3 adopter (advanced)	52	12.2	25	75	76.9	23.1	17.3	82.7	3.8	65.4	30.8

Conclusions

This study reinforces the case for accelerating sustainable cattle ranching in Olancho, Honduras, where extensive systems have contributed to environmental degradation, including deforestation and biodiversity loss. Adoption patterns suggest a clear pathway of change: producers have prioritized foundational investments that protect and strengthen the forage base – most notably improved pastures (75%) and live fences (51%) – while gradually adding practices that improve system structure, water security, and tree cover. A meaningful share of farms is progressing through intermediate uptake of water troughs (43%), paddock division (31%), agroforestry areas (26%), and early silvopastoral elements such as natural regeneration (27%) and planted trees (20%), alongside the continued presence of primary (24%) and recovering forests (22%). In contrast, more management-intensive and environmentally innovative practices remain limited – rotational grazing, waste management, and biodigesters are still rare – and agricultural diversification is low, confirming livestock as the dominant livelihood focus. Overall, the sector shows strong momentum on "pasture-and-forage basics," while the next frontier is scaling integrated management packages, diversification, and environmental innovations to deepen resilience and sustainability.

Using adoption profiles to characterize progress toward sustainable silvopastoral systems shows that most producers sit in the middle of the spectrum rather than at the extremes: 57.4% are implementing at least a basic package (Levels 1–3), and 39.5% are already in more integrated tiers (Levels 2–3) that combine practices more coherently (e.g., improved pastures and trees plus infrastructure such as forage banks). This signals real momentum, but also a large "entry-stage" segment –43% in non-adoption or scattered practice use– where better follow-up and enabling conditions could unlock progression. Differences by producer characteristics are clear: women's adoption is more polarized (higher non-adoption and slightly higher Level 3, fewer in Levels 1–2), pointing to the need for more intentional pathways that address decision-making, labor, and access constraints. Farm size contrasts are sharp, with small farms (<15 ha) much more likely to reach Levels 2–3 than larger farms, suggesting larger operations face distinct management or cost barriers. Younger producers (<30) show higher non-adoption, but those who adopt often move quickly into Level 2, while valleys tend to reach higher levels than upper zones—reinforcing the role of sustained enabling support. Participation in FFS is a key driver of adoption. Producers attending three or more FFS are more likely to reach higher adoption levels, while limited participation is associated with non-adoption or scattered practices. This highlights the importance of sustained training and accompaniment for scaling integrated and resilient management practices in the region.

Predicting adoption rates from producer and production characteristics. Adoption of sustainable cattle practices in Olancho appears shaped less by farm size or income and more by information and institutional support. Access to agroclimatic information and Heifer promotores shows the strongest positive association with adoption, highlighting the importance of decision-relevant climate services and last-mile technical accompaniment. At the same time, adoption is uneven by place – with significantly lower probabilities in Dulce and San Esteban – and a gender gap persists, with women less likely to adopt under current conditions. These patterns point to actionable leverage points: improve climate-information delivery and interpretation, strengthen promotor coverage and continuity, and design targeted measures that reduce barriers for women and for municipalities facing structural constraints.

The adoption-level classification is useful as both a diagnostic and management tool for strengthening sustainable livestock programming. By segmenting producers into non-adopters, scattered adopters, and basic, intermediate, and advanced adopters, it helps identify differentiated producer profiles and tailor extension and incentives to match each group's needs and capacity. The profiles also reveal where producers are getting "stuck" (for example, adopting improved pasture but not progressing to tree integration or forage reserves), distinguishing early uptake from deeper systems transition. As a simple tracking framework, it provides a practical way to monitor whether programming is actually shifting households toward more resilient, sustainable configurations over time. Used this way, the approach can support more inclusive and effective transformation of the cattle sector in Olancho and similar regions—guiding interventions that scale sustainable management, strengthen environmental outcomes, and improve producer livelihoods.

Policy recommendations

- *Strengthen Farmer Field Schools on sustainability and fund follow-up:* Participation is high in milk quality, animal health, and farm management, but lower for sustainable cattle practices; require stronger sustainability content and add on-farm coaching to help producers move up adoption levels.
- *Invest in decision-ready agroclimatic services and embed them in extension:* Expand access to localized climate information and translate it into practical guidance (pasture renewal/rotation, water planning, forage options), delivered through promotores and trusted channels.
- *Promote stepwise "practice packages," not single practices:* Offer sequenced bundles (starter > next-step > advanced) and reward integrated packages (Levels 2–3), where resilience and environmental benefits are strongest.
- *Prioritize the "entry-stage" group with practical enabling supports:* Reduce first-step barriers through access to seedlings and forage material, low-cost fencing options, basic water solutions, and clear checklists on "what to do next" to reach Level 1 and Level 2.
- *Target structural gaps by place and by gender:* Strengthen promotor coverage and continuity in lower-probability municipalities and implement targeted measures that remove constraints faced by women (access to inputs/credit, time and mobility constraints, tailored training formats).
- *Track progress using adoption levels as the core monitoring metric:* Use the profile framework to identify bottlenecks, segment support, and verify that programming is moving households from single practices toward integrated, resilient systems over time.

By implementing these recommendations, policymakers can foster a more inclusive and effective transition toward sustainable cattle ranching in Olancho, addressing environmental challenges while improving the livelihoods of producers and promoting long-term agricultural sustainability.

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Acknowledgements

This work was carried out as part of the Heifer International Project HN5424, Title: *Leveraging success II*, the CGIAR Science Program on Sustainable Animal and Aquatic Foods (SAAF), and the CGIAR Initiative on Sustainable Animal Productivity (SAPLING). We thank all donors who globally support our work through their contributions to the CGIAR System. The views expressed in this document may not be taken as the official views of these organizations. The funders had no role in the design of the study in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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June 2025