Upscaling agroforestry for dairy production in Nepal: the role of the Setidevi Cooperative

Agroforestry case study 5. Nepal

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FFF surveys of knowledge needs in areas of land and natural resources from 41 forest and farm producer organisations (FFPOs) in six countries carried out in 2018 identified two top priority research needs: climate resilience information and options; and diversified climate-smart agroforestry options. By 2022 the FFF programme had assembled case studies and guidance on the first of these priorities, climate resilience, spread in a peer-to-peer learning event in Vietnam (see www.iied.org/20311iied and www.iied.org/21211g). In 2023 further work was commissioned resulting in guidance on how FFPOs can advance agrobiodiversity for climate resilience, with another peer-to-peer learning event in Nepal (see www.iied.org/22251iied and www.iied.org/22451g). Agroforestry systems are the central land use system that allows integration of trees, crops and livestock to advance agrobiodiversity and climate resilience. Now in 2025, the FFF is focusing on the second identified priority knowledge need: how to increase adoption of diversified climate-smart agroforestry. The coproduction process used by FFF draws insights from across the world of the most innovative FFPOs that have encouraged the adoption of agroforestry systems – which are then blended with an academic review of agroforestry adoption – to provide FFPOs with the latest thinking and best practice in promoting agroforestry. This case study is part of that process.

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Cover photo: Agroforestry landscape of the Setidevi Cooperative © Deepika Acharya

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Abbreviations

CDCAN	Central Dairy Cooperative Association Limited Nepal
FAO	Food and Agriculture Organization of the United Nations
FFF	Forest and Farm Facility
FFPO	Forest and farm producer organisation
SACCO	Savings and credit cooperative organisation

Summary

This case study highlights the innovative approaches taken by the Setidevi Dairy Producers Cooperative Society Limited (Setidevi Cooperative) to promote agroforestry systems that enhance climate-resilient landscapes and improve livelihoods. The Setidevi Cooperative is a forest and farm producer organisation (FFPO) that was established in 1994, and from an initial 26 founding members it now boasts 1,048 members, with approximately 600 households supplying around 700 litres of milk every day through its seven milk-collection centres.

Approximately 400 hectares of agroforestry systems have been established in the landscape of the Setidevi Cooperative, involving a mix of systems that are locally described as silvoarable, horticulture, agrosilvopastoral and home garden systems. Put more simply, most farmers practice agroforestry by combining the rearing of livestock with the cultivation of trees and crops. There is substantial diversity in these systems. Emergent timber or fruit trees include species such as needlewood (*Schima wallichii*), sal (*Shorea robusta*) and pine (*Pinus roxburghii*), while upper-canopy fruit trees include species such as jackfruit, mango, avocado and pear. Middle-canopy fruit trees include species such guava, banana and papaya, while the lower canopy consists of dwarf trees and shrubs such as tanki, koiralo and mulberry. Under the canopy shade or in fields are grown shade-tolerant crops such as coffee or cash crops such as cabbage, cauliflower and tomato. These are complemented by basic staple crops such as rice and maize alongside root crops such as potato. Vines are also present, including malati and cucumber. Other important species include livestock fodders such as super napier grass, jai grass and daley ghas (a local fodder grass) alongside nitrogen-fixing hedges of utis) and ipil-ipil.

In a survey of smallholder farmers, most attribute their knowledge of agroforestry to traditional practices passed down from their ancestors. But they are also supported and encouraged by the Setidevi Cooperative to improve their livelihoods by selling milk and agricultural products. The FFPO encourages the uptake of agroforestry by promoting its benefits. These include improved soil health, increased fodder availability and higher income potential. The Forest and Farm Facility (FFF) programme supported the Setidevi Cooperative from December 2023 to December 2024 through the Central Dairy Cooperative Association Limited Nepal (CDCAN) to enhance dairy producers' capacity to adopt climate-smart practices such as agroforestry to improve farm productivity, reduce production costs and increase dairy farmers' resilience to climate change.

Improved uptake of agroforestry was achieved through awareness-raising campaigns and training programmes. The Setidevi Cooperative spread knowledge and design by establishing demonstration farms, distributing high-quality seeds such as super napier grass, and providing technical guidance on planting, harvesting and maintenance. To support farmers, the Setidevi Cooperative has built cooperation by organising farmers into cooperatives, offering financial incentives and facilitating peer-to-peer learning exchanges, where successful farmers inspire others to adopt agroforestry practices. The cooperative also helps farmers aggregate and sell their produce, linking them to local and regional markets for products such as milk, tomatoes and citrus fruits, which has increased incomes and encouraged diversification. Additionally, the Setidevi Cooperative has worked to overcome legal and policy constraints by advocating for supportive policies and addressing challenges such as limited access to credit and unclear land tenure. Finally, they have sustained the uptake of agroforestry systems by organising conducting training sessions on sustainable land management and pest control.

Through all these efforts, the Setidevi Cooperative has created a replicable agroforestry model that strengthens livelihoods through greater productivity and profitability, promotes environmental sustainability, and builds resilience to climate change.

1. Introduction

1.1 Nepalese context

The economy of Nepal is dominated by agriculture and forestry. Subsistence agriculture linked to forestry is the major source of livelihoods in rural areas (MoFSC 2014). Forestry, agriculture and humans have complex and inseparable relationships. In Nepal, agricultural systems are mostly traditional and oriented towards subsistence. The farming systems in Nepal rely on forests and trees for their sustainability (Amatya et al. 2018). For example, agroforestry trees are the most important source of fodder for livestock (Avis 2018).

Farmers in the hills have responded to forest degradation and deforestation by successfully implementing agroforestry system on their farmland to meet the immediate demand for food, fodder, fuelwood and small-sized timber products. Agroforestry systems in Nepal can be divided into two broad categories: farm-based agroforestry systems and forest-based agroforestry systems. Farm-based agroforestry systems include a wide range of systems known variously as home gardens, trees in agricultural fields, intercropping with tree horticulture, cultivation of annual crops with trees, trees at the periphery of agricultural fields, and woodlots (Ulak et al. 2021).

1.2 Apex-level CDCAN

The Central Dairy Cooperative Association Limited Nepal (CDCAN) was established in 1992 following the implementation of the Cooperative Act of 1991 in Nepal. It is the main organisation leading Nepal's dairy cooperative movement, helping dairy cooperatives and unions with technical support, advocacy and programmes to grow and sustain the dairy sector. Under CDCAN, one of the more promising member-based institutions is the Setidevi Dairy Producers Cooperative Society Limited.

1.3 The Setidevi Dairy Producers Cooperative Society Limited

The Setidevi Cooperative was officially established in 1994 in Dhulikhel municipality under the Cooperative Act of 1991 and Cooperative Regulations 1992 (Setidevi Cooperative 2023). The cooperative began by collecting 150 litres of milk daily from its 26 founding members and an initial share capital of 2,600 Nepalese rupees (US$19) in 1993.

The cooperative expanded its milk-collection centres in Chisapani, Padali and Deurali, which increased their milk production. Now, the Setidevi Cooperative has a total of 1,048 members, with 509 female and 539 male members, with approximately 600 households supplying milk daily. It collects around 700 litres of milk every day through its seven milk-collection centres. The average land area per household is approximately 0.38 hectares.

Figure 1. Setidevi Cooperative's demonstration dairy farm © D Acharya

In the last two years, the cooperative has constructed a demonstration dairy farm that includes 80 cows (Figure 1). It has become an example for other farmers in the locality, encouraging members to adopt professional dairy-farming practices. Furthermore, the cooperative has created paid employment opportunities for nearly 25 individuals. The cooperative was established to support the members in producing and marketing dairy products, and over time, it has expanded its services to include agricultural and livestock support.

The Forest and Farm Facility (FFF) programme of the Food and Agriculture Organization of the United Nations (FAO) supported the Setidevi Cooperative from December 2023 to December 2024 through CDCAN. The intervention aimed to enhance dairy producers' capacity to adopt climate-smart practices and sustainable farming techniques. The intervention contributed to improving farm productivity, reducing production costs, and increasing dairy farmers' resilience to climate change.

1.4 Methodology for the case study

The case study area is located in Ward 2 of Dhulikhel municipality, Rabi village, at an altitude of 1,300–1,500m in the subtropical zone, characterised by seasonal rainfall and moderate temperatures.

Setidevi Cooperative was selected for the study after consultations with the FAO Nepal and CDCAN. There is a variety of deciduous trees, bushes and grasses in this area. Broadleaf tropical and subtropical woods can be found at lower elevations. Numerous species, including sal (*Shorea robusta*), sissoo (*Dalbergia sissoo*), utis (*Alnus nepalensis*), needlewood (*Schima wallichii*) and different types of bamboo can be found in these woodlands. Agroforestry and farming are supported by the varied environment created by the landscape's combination of grasslands, woods and agricultural areas.

Figure 2. Interviewing farmers during the field survey © D Acharya

Both primary and secondary methods were used to collect the data for this study. The primary data was gathered mainly through a questionnaire survey, which served as the key tool for collecting firsthand information. A structured questionnaire was used to gather data from 20 households in Rabi village,

ensuring a systematic approach to understanding smallholder farmers practices and experiences. The survey was conducted at ten male-headed and ten-female headed farms, who had an average of 30 years of farming experience. The survey was done 4–8 January 2025 and most respondents were dairy farmers, with the rest practising seasonal crop cultivation and mixed farming as well. An interview was also conducted with the leader of the Setidevi Cooperative to gain key insights into farmers' perceptions and to understand the evolution and development of the FFPO.

The primary data collected included livestock information, information on fodder trees and fruit trees, consumption of fodder and fuelwood, production and consumption of agricultural products and others. The secondary data collected involved information regarding access to water resources and availability, and land utilisation etc. Data collection from secondary sources was also made to validate some of the primary data and to supplement the data on demographic aspects. Secondary information was also collected from related publications, the internet and annual reports.

2. Agroforestry systems practiced

2.1 Types of agroforestry systems and component species

Overall, respondents initially saw the highest potential benefits of agroforestry being shade and shelter for livestock and offering greenhouse gas emissions reduction. When asked about the perceived benefits from agroforestry categorised under categories of nutritional, economic, ecological and social benefits, the most common perceptions of benefits also included improved food security, increased income and soil health while preserving cultural traditions. Local descriptions of the agroforestry systems most widely used in the region include the four categories shown in Table 1, with examples shown in Figure 3 (sourced from Macqueen and Springgaye, In Press).

Table 1. Types of agroforestry practiced by the Setidevi Cooperative

#	Agroforestry systems	Species grown
1	Silvoarable systems	Tea, cardamom and coffee are grown under *Alnus nepalensis.* Amriso (*Thysanolaena latifolia*) is grown under *Alnus nepalensis* at wider spacing.
2	Horticulture	Fruit trees (such as mango, lychee, banana) along with seasonal agricultural crops such as tomatoes and potatoes.
3	Agrosilvopastoral systems	Ceral crops (maize, wheat, millet), lentils and vegetables such as cabbage, cauliflower and potatoes are grown under naturally growing *Alnus nepalensis*, *Schima wallichii* and *Albizia sp.* that are harvested in a zero-grazing cut-and-carry system for livestock including goats, cows and buffalo (a feeding method where fresh grass is cut daily and delivered to housed livestock).
4	Home gardens	Cultivation of a wide variety of cereals, vegetables, fruit trees, fodder and livestock.

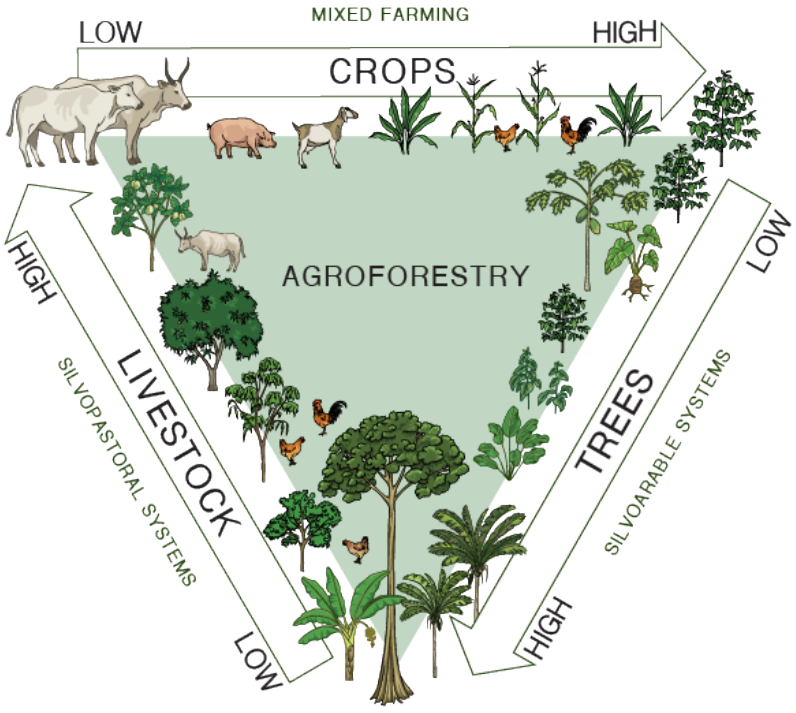

Figure 3. Different types of agroforestry system © Ria Mishaal (Source: Macqueen and Springgaye, In prep.)

Within these various agroforestry systems there are a number of different plant and animal components that provide a three-dimensional structure to the system. While not all components were found in all areas, the main components and species within them are shown below in Table 2 (see also Figure 4).

Table 2. Main species found in the area

Component	**Species**
Emergent timber or fruit trees	Needlewood (*Schima wallichii*), sal (*Shorea robusta*), *Castanopsis indica*, *Quercus semicarpifolia,* baanjh (*Quercus leucotrichophora*), phalat (*Quercus lamellose*), kaiyo (timber species), pine (*Pinus roxburghii), Terminalia bellirica*
Upper-canopy fruit trees	Jackfruit (*Artocarpus heterophyllus*), mango (*Mangifera indica*), lychee (*Litchi chinensis*), lapsi (*Choerospondias axillaris*), amla (*Emblica officinalis*), avocado (*Persea americana*), pear (*Pyrus spp*)
Middle-canopy fruit trees	Guava (*Psidium guajava*), banana (*Musa spp*), papaya (*Carica papaya*), orange (*Citrus sinensis*), lime (*Citrus aurantifolia*), plum (*Prunus spp*), persimmon (*Diospyros kaki*), pomelo (*Citrus maxima*)
Dwarf trees and shrubs	Tanki (*Bauhinia purpurea*), koiralo (*Bauhinia variegata*), kutmero (*Litsea monopetala*), mulberry (*Morus spp*), bakaino (*Melia azedarach*)
Shade-tolerant crops (including cash crops)	Coffee (*Coffea arabica*), cabbage (*Brassica oleracea var. capitata*), cauliflower (*Brassica oleracea var. botrytis*), tomato (*Solanum lycopersicum*), mustard (*Brassica juncea*)
Basic crops	Rice (*Oryza sativa*), maize (*Zea mays*), barley (*Hordeum vulgare*), millet (*Poaceae spp*), lentils (*Lens culinaris*), chickpeas (*Cicer arietinum*), broad beans (*Vicia faba*), turmeric (*Curcuma longa*)
Root crops	Potato (*Solanum tuberosum*), carrot (*Daucus carota subsp. Sativus*), radish (*Raphanus sativus*)
Vine crops	Malati (*Jasminum spp*), cucumber (*Cucumis sativus*)
Livestock fodder species	Super napier grass (*Pennisetum purpureum hybrid*), jai grass (*Bromus spp*), daley ghas (local fodder grass)
Nitrogen-fixing hedges	Utis (*Alnus nepalensis*), ipil-ipil (*Leucaena leucocephala*)
Additional species planted on field boundaries	Kutmero (*Litsea monopetala*), badahar (*Artocarpus lakoocha*), khanyu (*Ficus semicordata*), Indian bay leaf *(Cinnnamomum tamala)*

Figure 4. Fruit species in the agroforestry system (mango, lychee and pomegranate) © D Acharya

2.2 Socioeconomic observations on those practicing agroforestry

The literacy rate in Rabi village is around 80%, with most people having an education above 10th grade (15–16 years of age). Although the literacy rate is quite promising, most people are unemployed. Few people are uneducated and most are elders. The villagers therefore still relie for their sustenance on rainfed agricultural land and forests.

Approximately, half of the houses in all the villages are made of cement and the rest were traditional types made of wood, straw and mud. With good connectivity to the local market and capital city, the use of fuelwood for cooking was minimal. Use of gas cylinders for cooking and household activities was found in many areas.

The main occupation of interviewees is agriculture, which is practiced at a small scale on terraced farms and is sufficient to feed an entire family for the year. Dairy production is the main source of employment in Rabi village. A few vegetables and fruits from agricultural land are sold on the open market to earn cash income, although villagers have indicated that they are interested in expanding the cultivation of cash crops. Some people work also in cooperatives and other welfare schemes run by the government and they sometimes work as labourers in the private construction sector.

2.3 Main cropping patterns

The cropping system in the study area is traditional and rainfed. Three land-use cover types were identified: settled farming, forest land and barren land. General agriculture details for the study area include a basic two-seasonal production cycle as shown in Table 3.

Table 3. Main crop species grown in the two main planting seasons

Winter season crops	Rainy season crops
Wheat	Maize
Barley	Millet
Potato	Rice
Mustard	Tomato
Carrot/radish	Turmeric
Cauliflower/cabbage	Cucumber
Lentils (masoor, moong, rajma)	Cowpea
Chickpeas	Soyabean
Broad beans	

2.3 Main livestock species and their agroforestry role

Rearing livestock is an integral part of the smallholder farmers' social system. Each family maintains 3–5 animals of an Indigenous breed (cattle, oxen, buffalo, goats, chickens and pigs) that are reared using traditional methods. Animal husbandry and farming in hill regions are indeed complementary and closely interlinked, forming a synergistic relationship that enhances both productivity and sustainability. The animal not only provides milk and other products but also provides manure, a rich source of organic fertiliser, which improves soil fertility and enhances crop yields.

Figure 5. Preparing organic fertiliser made from animal manure using a biodigester © D Acharya

A simple illustration of how livestock and crop farming are interrelated with each other is shown in Figure 6.

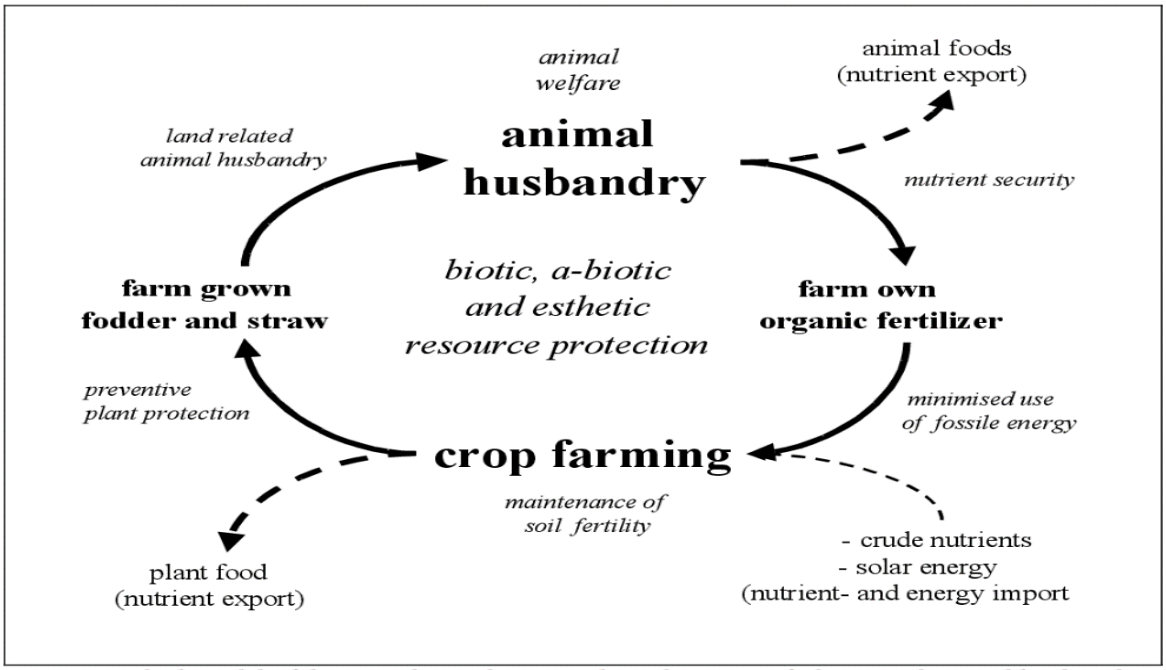

Figure 6. Illustration of how livestock interact with crops in agroforestry systems

3. Motivation to adopt agroforestry systems

The Setidevi Cooperative started promoting agroforestry in the mid-2000s as a way to improve sustainability and support farmers. By working with local experts, the cooperative introduced the idea of combining trees with dairy farming to help farmers grow more fodder, improve soil health and make their farms more resilient to challenges such as climate change.

To encourage farmers, the cooperative organised training programmes and awareness-raising campaigns, set up demonstration farms to show how agroforestry works, and supplied seeds of napier grass and other suitable tree and crop species to support the transition. Farmers learnt how planting trees alongside crops and livestock could increase their income while protecting the environment. Over time, this initiative helped farmers earn more, improved the land and made the dairy cooperative more successful. Today, agroforestry is a key part of the region's efforts to balance farming with nature.

3.1 Nutritional benefits

During the field visit, a questionnaire survey with farmers and key information interviews was conducted with the stakeholders to understand the perceived nutritional benefits of agroforestry (Figure 7). About 70% of the respondents reported that food security had improved with the proper use of their agroforestry systems. This was mainly explained by the improvements to the grazing system provided by fodder components within the agroforestry systems. Also, they clarified that the increase in milk production from the livestock had also been complemented by increases in the production especially of potato, wheat and rice as compared to the previous year. Also, 20% of the respondents reported a slight increase in the variety of food crops grown, including fruits, vegetable and grains. Only 10% responded that they had perceived no changes.

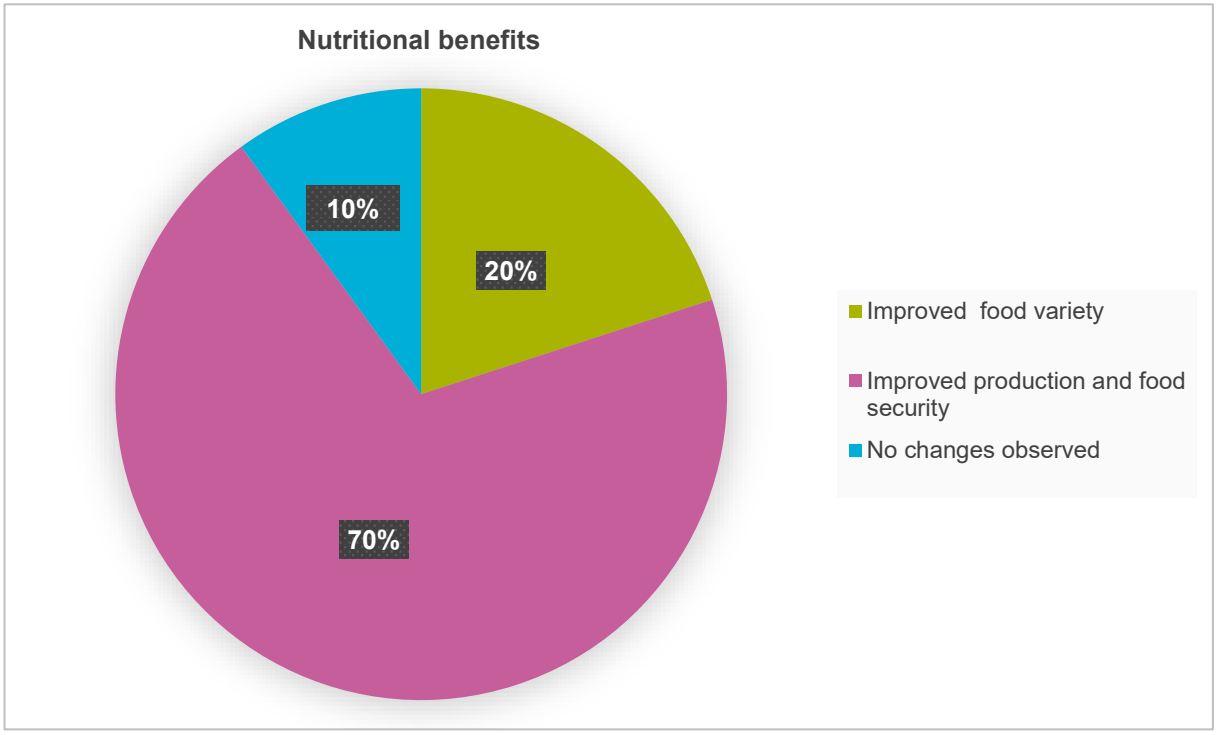

Figure 7. Perceived nutritional benefits of agroforestry

3.2 Economic benefits

During the survey, when the respondents were asked whether agroforestry had an impact on their economic status, many of them (48%) of them stated that their economic status had increased from their farm income. Agroforestry practices have given direct benefits through the selling of timber,

fuelwood, fodder, fruits, crops and vegetables. The increasing use of seasonal and perennial crops has also reduced their dependence on a single crop and products, so as to give financial security. Perennial crops along with staggered planting or harvesting schedules have ensured more continuous income, rather than spiked seasonal earnings, with some reduction in overall labour. For example, citrus species such as oranges and lemons produce yields for many years after planting. Farmers often intercrop annual crops such as maize, millet and ginger along with perennial crops such as citrus.

Overall, however, in Rabi village, the majority of farmers said they relied on milk and dairy products as their main source of income, followed by potatoes, tomatoes and paddy rice. Figure 3 shows how the use of agroforestry systems has increased milk yields through the better provision of fodder. The R square value gives the trend: milk production is increasing by 0.86 x 1,000 litres per year.

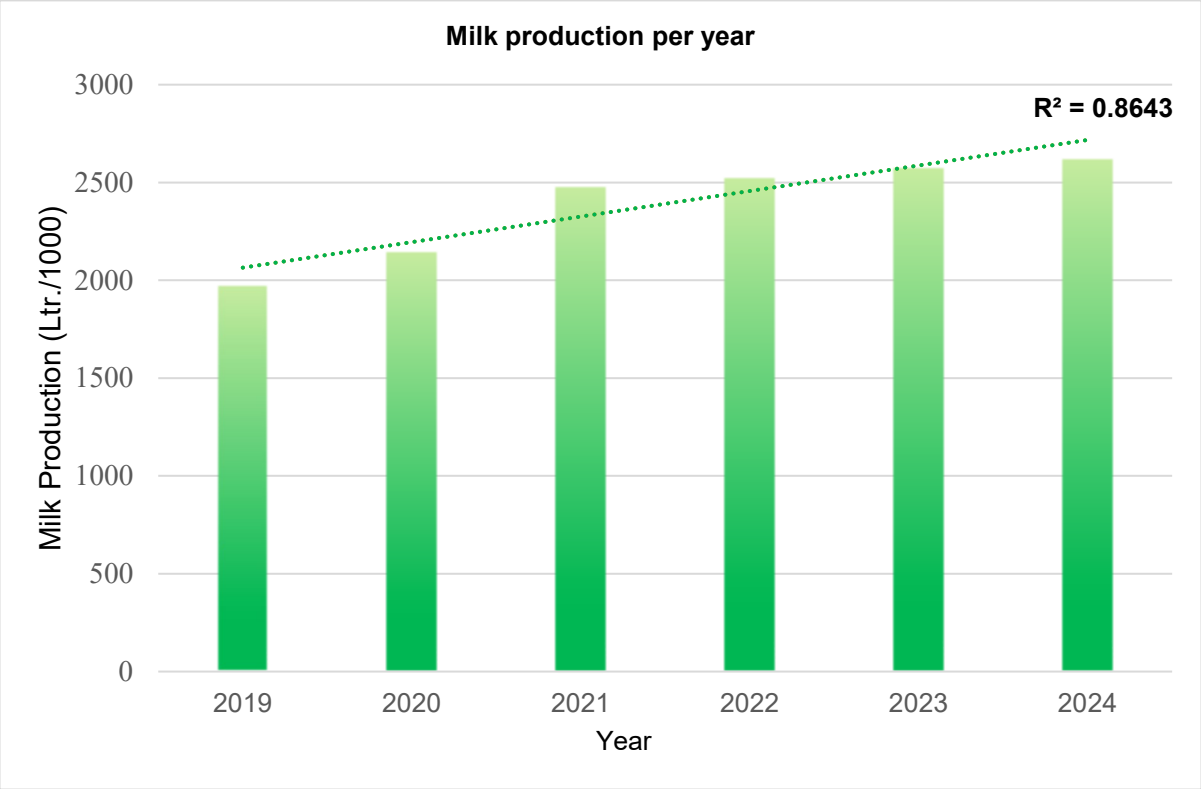

Figure 8. Milk production per year in Setidevi Cooperative (2019–2024)

3.3 Ecological benefits

Agroforestry systems applied at the study site have provided various ecological benefits that contribute to environmental sustainability and ecosystem health. It has been observed that after the practice of agroforestry, soil structure and moisture-holding capacity have increased. Also soil fertility has increased as leaf litter and organic matter enrich the soil with nutrients. During the survey, it was found that the majority of smallholders felt most positively about soil health improvement and cleaner air, followed by improvements to biodiversity conservation and reduced deforestation pressure. Around 15% of the respondents also shared the view that agroforestry practices have helped in pest and disease control (see Figure 9).

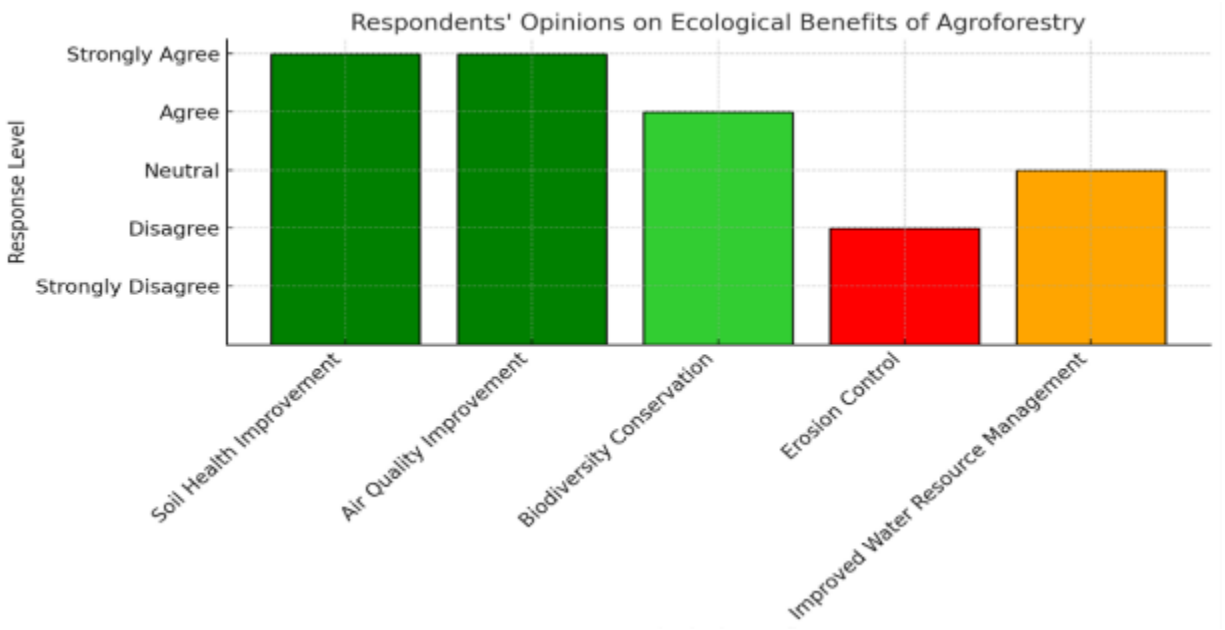

Figure 9. Perceived ecological benefits of agroforestry

3.4 Social benefits

Agroforestry practices also offer significant social benefits, particularly in terms of preserving cultural traditions and promoting inclusivity for women, marginalised groups and youth (Figure 10). About 90% of respondents said they relied on Indigenous knowledge of plant species, their uses and sustainable land-management practices. This has helped to preserve and transmit Indigenous traditional knowledge to future generations as well.

Farmers have planted trees or integrated plants that hold cultural or religious significance such as *Ficus religiosa* (peepal), *Elaeocarpus ganitrus* (rudraksh) and others. Agroforestry systems have supported marginalised groups by providing access to land, resources and technical support, reducing social inequalities. During the survey, it was recorded that four of the respondents were aged 30 to 35, which also shows how youth are also being included into agroforestry practices and even planning to establish agrotourism, tree nurseries and to implement other novel ideas.

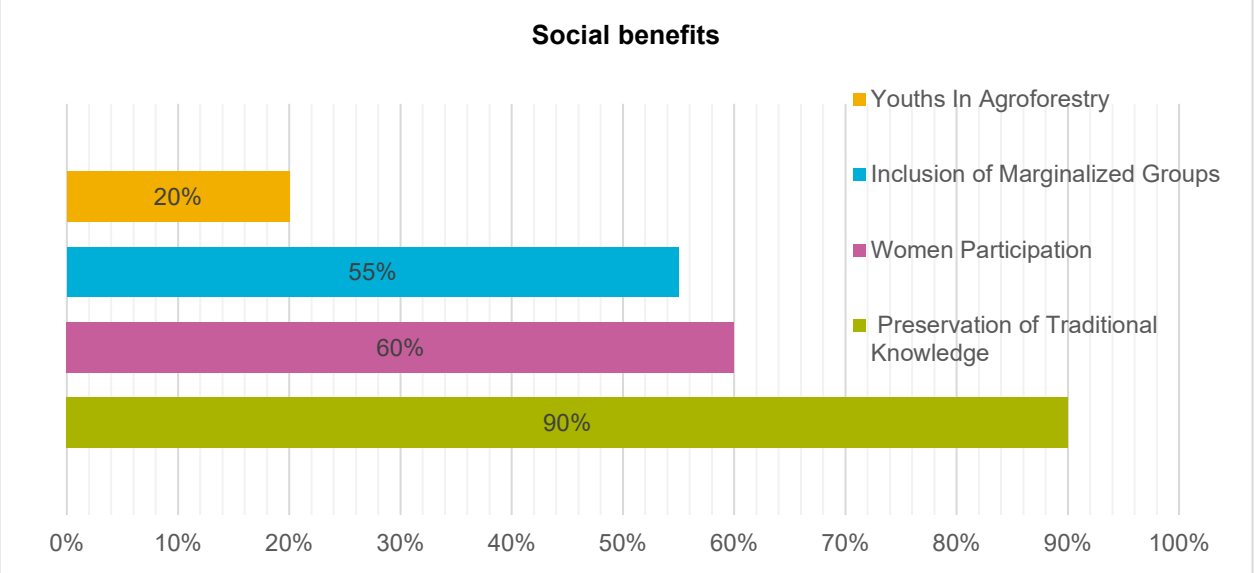

Figure 10. Perceived social benefits of agroforestry relating to inclusion and preservation of culture

4. Design and installation of agroforestry systems

4.1 Guidance on agroforestry installation

The Setidevi Cooperative started its operations by promoting milk production and distributing it in cans, while establishing a basis for the expansion of their cooperative. As the cooperative expanded, farmers were influenced by its success and encouraged to farm livestock. While most farmers traditionally raised buffaloes, they shifted to raising cows because of their superior milk output, with cows producing around 6–7 litres of milk per day compared to under 3 litres per day for buffalo.

To promote livestock farming, the Setidevi Cooperative also introduced the idea of cultivating high-yield fodder crops such as super napier grass and other suitable grasses and the tree *Artocarpus lakoocha* in their terraces of their land, which has provided some relief for feedstock and efficiently utilised their available space.

Figure 11. Jai grass grown as a cattle fodder © D Acharya

Additionally, the cooperative has promoted the adoption of agroforestry systems by offering rewards. For example, agroforestry farmers who produce the most milk are rewarded with cash incentives, encouraging healthy competition among participants.

One inspiring example from Setidevi Cooperative in 2003–2004 was Ramchandra Neupane who was awarded for managing to produce 6,108 litres of milk annually. By the fiscal year 2021–2022, Arjun Neupane set a record by producing 75,341 litres of milk annually which represents a more than twelvefold increase over 19 years. This demonstrates the significant impact of the cooperative's guidance and motivational strategies on agroforestry adoption and productivity.

4.2 Seed sources for planting materials

Through the Setidevi Cooperative, farmers have obtained planting materials and seeds for their agroforestry components. Access to high-quality seeds, such as those for super napier grass and other fodder trees, was made possible in large part by the cooperative, which sourced the seeds from CDCAN. The FFPO also offered professional planting advice and maintenance guidance for these crops. This has made it possible for farmers to successfully set up and maintain their agroforestry systems.

In addition to distributing seeds, the Setidevi Cooperative has collaborated with the Alchechaur Community Forest and other local vendors to guarantee a steady supply of planting materials of other

trees and crops, improving accessibility for farmers. They have planted many fodder plants and grasses in the community forest, providing farmers with a sustainable and easily accessible resource

4.3 Management issues

Managing pests and diseases that affect fodder crops, maintaining soil fertility and guaranteeing enough feedstock for livestock are the primary management challenges for the agroforestry system. Setidevi Cooperative has taken a number of actions to address these issues:

- **Feedstock management:** To guarantee that cattle have enough nutrition all year round, the cooperative actively provides feedstock and fertilisers to its members. The shortage of livestock feed has been significantly reduced with the introduction of super napier grass.
- **Technical guidance:** Technical instructions on appropriate agroforestry management techniques have been given by the FFPO. Farmers have received education on the value of incorporating fodder crops, preserving soil health and fodder tree trimming methods.
- **External expertise:** Setidevi Cooperative has invited outside technical experts to conduct training sessions and workshops to better assist farmers. For example, experts have helped farmers tackle specific issues such as pest control, soil fertility management and crop diversification, while also sharing cutting-edge agroforestry techniques. The cooperative effectively oversees these partnerships, guaranteeing that farmers obtain pertinent and timely assistance.
- **Market access:** Linking to the market is a major obstacle to sustainable agriculture. Farmers are able to access direct markets thanks to the FFPO. The Setidevi Cooperative operates a milk-collection centre in Rabi village, where farmers deliver their milk both early in the morning and in the evening. They are paid based on the fat content of the milk. The cooperative collects the milk and sells it in local markets such as Banepa, Bhaktapur and Kathmandu, ensuring farmers have reliable market access. According to one farmer, for crops such as wheat and millet, and vegetables such as tomatoes and rice, buyers often come directly to the village, so farmers do not face challenges in finding a market for these products. Prices for milk are negotiated based on market rates, while for crops, the buyers and farmers typically agree on prices through direct discussions. Farmers are able to save time and effort by not having to travel great distances to sell their goods.

Setidevi Cooperative has made their community a shining example of an agroforestry system that works by creating a creative and encouraging atmosphere. From offering seeds and training to guaranteeing market access and incentives, their all-encompassing strategy has turned Rabi village into a flourishing agricultural centre where farmers can achieve financial success.

5. Aggregation and sale of agroforestry products

5.1 Markets for agroforestry products and changes over time

Over time, milk production has increased significantly, marketed locally in Banepa, Bhaktapur and Kathmandu. Nevertheless, there has been a noticeable recent shift toward cultivating more market-oriented crops, such as tomatoes and potatoes, due to their higher commercial demand and profitability. The Setidevi Cooperative has played a significant role in encouraging commercial production by facilitating aggregation and providing market linkages again into local market towns. These efforts have led to increased income for farmers and improved market access.

The agroforestry system has also evolved, with greater integration of high-value crops alongside traditional subsistence farming. This shift has enhanced the economic viability of the system while maintaining its ecological benefits.

Setidevi Cooperative members now sell several commercially viable crop components, including tomatoes, lemons, cauliflower and potatoes, which are primarily sold in local markets. The main end markets for these products are local and regional (Rabi village, Banepa and Kathmandu). In Patlekhet, members sell approximately 40kg of tomatoes per day, which is distributed to local markets. In addition to tomatoes, lemons, cauliflower, potatoes other various seasonal vegetables are also sold in these markets.

Alongside these commercial activities, subsistence farming is practiced, with households growing vegetables and other crops primarily for their own consumption to meet daily dietary needs. This dual approach of market-oriented and subsistence farming supports both the local economy and household food security in the region.

Farmers have transitioned from monocropping to diversified systems, boosting resilience and income. One farmer plans to expand agroforestry practices to additional areas, depending on the continued success of his current efforts. He stated that further expansion will be pursued only if his existing agroforestry plot achieves the desired outcomes as anticipated.

5.2 Financing of agroforestry businesses

At Setidevi Cooperative, the initial costs were covered using the membership capital, which was collected from the members of the cooperatives in annual fees. They also secured farmland with support from the provincial ministry and leased additional land for 10 years. While they did not take external loans, they received seedlings from CDCAN to help their members grow fodder for livestock. The cooperative also actively supports its farmers by running a savings and credit cooperative organisation (SACCO) that provides loans and offers incentives to those who produce the most milk.

5.3 Future plans

This FFPO plans to use external social networks and contacts to explore new markets and increase the commercial benefits from agroforestry products. In the future, they aim to develop branded labelling for their feedstock, which is currently produced only for their members. These efforts are expected to further enhance the economic and environmental sustainability of the agroforestry system while improving the livelihoods of member farmers.

6. Conclusions and recommendations

6.1 Key innovations

Setidevi Cooperative members, who are also part of the Alchechaur Community Forest, have devised a smart solution to tackle fodder shortages. They have planted many fodder plants and grasses in the community forest, providing farmers with a sustainable and easily accessible resource. Their efforts have improved livestock productivity and reduced the strain on private farmlands. The integration of cooperative efforts with community forestry highlights a replicable model for strengthening agroforestry systems, promoting resilience and ensuring long-term resource sustainability.

In addition to this, Setidevi Cooperative has played a decisive role in helping smallholder farmers adopt diverse agroforestry systems through several key innovations:

- **Persuasion and raising awareness:** The cooperative has conducted training programmes and awareness-raising campaigns, and has established demonstration farms to showcase the benefits of agroforestry. Farmers have been shown how integrating trees with crops and livestock could improve soil health, increase fodder availability and boost income.
- **Seed and technical support:** The cooperative has provided high-quality seeds, such as super napier grass and fodder trees (often in association with the Alchechaur Community Forest), along with technical guidance on planting and management.
- **Enterprise development:** The cooperative has encouraged farmers to diversify their income sources by integrating high-value crops such as tomatoes, potatoes and citrus fruits alongside traditional subsistence farming. They have also facilitated market linkages, enabling farmers to sell their products directly to local and regional markets.
- **Financial support:** Setidevi Cooperative has used profits from its dairy operations to fund agroforestry initiatives, providing loans and incentives from their own SACCO to farmers.

These innovations have not only improved farmers' livelihoods but also strengthened the resilience of their farming systems against climate change and resource scarcity.

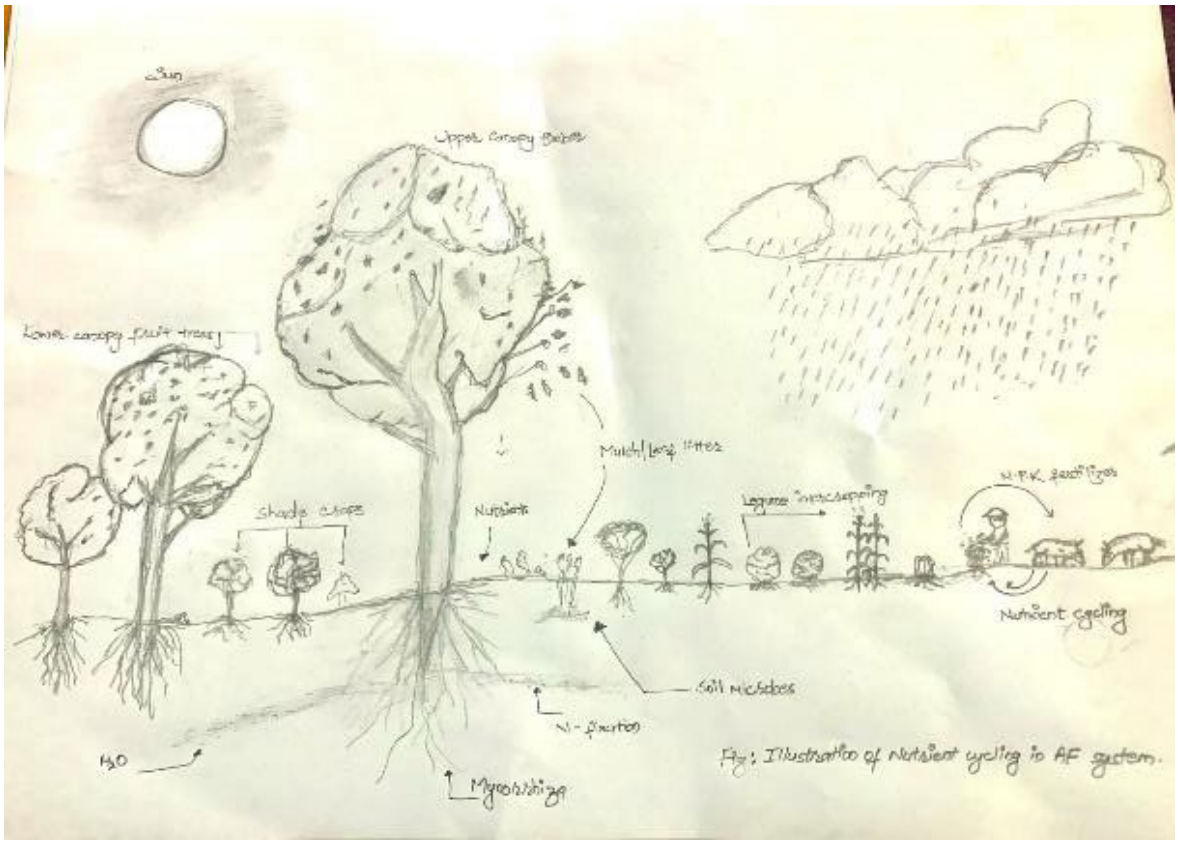

Figure 12. Farmer diagram of a typical agroforestry plot

6.2 Remaining challenges

Despite the successes, several challenges remain:

- **Soil erosion and land management:** Some farmers have reported increased soil erosion, particularly after planting super napier grass. Improved land-management practices and soil-conservation techniques are needed to address this issue.
- **Human-wildlife conflict:** As agroforestry expands, conflicts with wildlife, such as crop damage by animals, have become a concern. Effective mitigation strategies, such as fencing or community-based wildlife management, are required.
- **Labour shortages:** Many farmers face a lack of manpower, especially during peak agricultural seasons. Mechanisation or community labour-sharing models could help alleviate this problem.
- **Market access and value addition:** While the cooperative has improved market linkages, farmers still need better access to larger markets and value-added opportunities for their products. Developing branded labels and exploring export markets could enhance profitability.

To overcome these challenges, the Setidevi Cooperative can:

- **Collaborate with government agencies and nongovernmental organisations (NGOs)** to provide training on soil conservation and wildlife management.
- **Advocate for policies that support agroforestry** and provide financial incentives for farmers.
- **Explore partnerships** with private-sector actors to improve market access and value addition.
- **Secure external project support** from development partners, such as funding for infrastructure, research and capacity-building programmes, which would be instrumental in addressing these challenges.

6.3 Policy support and barriers

Setidevi Cooperative members identified several policies that have supported or hindered agroforestry systems:

- **Supportive policies:** The Cooperative Act of 1991 and the establishment of CDCAN have provided a legal framework and institutional support for cooperatives like Setidevi. Additionally, Dhulikhel municipality's goal of planting 100,000 trees in three years has encouraged agroforestry adoption.
- **Barriers:** Limited access to credit and financial services for smallholder farmers remains a significant barrier. Additionally, unclear land-tenure policies and lack of technical support from government agencies have hindered the scaling up of agroforestry systems.

6.4 Policy recommendations

To create a more enabling environment for the spread of agroforestry systems, the following policy changes and external support are recommended:

- **Financial incentives:** The government should introduce subsidies or low-interest loans for farmers adopting agroforestry practices. This would help cover initial costs and encourage wider adoption.
- **Technical support:** The government should strengthen extension services to provide farmers with ongoing technical guidance on agroforestry management, pest control and soil conservation.
- **Land tenure security:** Clear and secure land-tenure policies should be implemented to ensure farmers have long-term rights to their land, encouraging investment in agroforestry.
- **Market development:** Policies that promote market access, value addition and branding of agroforestry products should be prioritised. This could include establishing agroforestry product certification schemes and facilitating export opportunities.
- **Research and development:** Increased investment in research to develop climate-resilient agroforestry species and practices would benefit farmers. Collaboration between research institutions, FFPO and farmers is essential.

External support partners can play a crucial role by:

- **Providing funding** for capacity-building programmes, infrastructure development and research initiatives.
- **Facilitating knowledge exchanges** and best practices through regional and international networks.
- **Advocating for policy changes** at the national and local levels to support agroforestry adoption.

By addressing these challenges and implementing the recommended policies, agroforestry systems can be scaled up, leading to improved livelihoods, enhanced environmental sustainability and greater resilience to climate change.

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