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From Subsistence to Sustainability: Evaluating the Livelihood Outcomes of Agroforestry in Kavrepalanchok, Nepal

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Abstract

Agroforestry in Nepal is considered as a key driver of sustainable livelihood which links agriculture, economy and environment for income generation and resource conservation. This study examines the evolving agroforestry practices in Bethanchwok Rural Municipality, Kavrepalanchok, Nepal, emphasizing their contribution to sustainable livelihoods. Using a mixed-methods approach, primary data are collected through household surveys, key informant interviews, and field observations, while secondary data are gathered from scholarly sources and government records. Findings indicate a shift from traditional subsistence-based farming to commercial oriented agroforestry remarkably contributing increased farm output and income, food security, and surplus time for women due to easy access to fuel-wood, fodder and such. Despite its contributions to food security, income diversification, and environmental conservation, agroforestry faces barriers such as policy gaps, limited market access, labour shortage, and insufficient local governance support. The study concludes that agroforestry is indispensable for sustainable rural development and recommends policy reforms, capacity-building initiatives, and improved market infrastructure.

Keywords: Agroforestry, sustainable livelihood, bethanchwok, income diversification, food security, climate resilience

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Introduction

Agroforestry integrates trees, crops, and livestock on the same land, offering economic, social, and environmental benefits. Agroforestry is widely promoted as a sustainable approach to managing natural resources. As a land use practice, it involves the integration of trees, crops, and livestock in coordinated spatial or temporal arrangements. This method, practiced by farmers for generations across many countries, aims to enhance, diversify, and sustain economic, environmental, and social benefits (Amatya et al., 2018). Agroforestry has widely taken as a strategic tool to increase resilience in farming system along with reducing farm vulnerability and climate effects (ICIMOD, 2018). It is an approach that can enhance food security and open livelihood options along with addressing climate threats (Tiwri et al. 2017; Adhikari et al., 2018). It is considered as most sustainable system of land resource management globally because of socio-economic benefits it offer (Bansal, 2021). Duffy et al., (2021) focused the multi-dimensional advantages of agroforestry offering higher crop productivity, alternative employment, reduced fuel wood dependence, and improved access to medicinal plants jointly contributing enhanced food security and ecological sustainability. Mukhlis et al. (2022) added that agroforestry can improve ecosystem services by enhancing soil structure, boosting carbon storage, and increasing the land's capacity to retain water. In addition to sustaining local livelihoods, this form of land management has played a key role in diversifying income sources and strengthening socio-ecological resilience to climate change. Within this integrated farming system, agriculture and forestry are deeply interconnected and cannot be treated separately. There is significant potential to enhance the productivity of both sectors, offering greater advantages to farming communities (Khatri & Timsina, 2023; Pandit et al., 2014; FAO & ICRAF, 2019). More specifically, as a strategic tool contributing social, economic and ecological support, it has true potential to navigating sustainable development goal by 2030 (Miller et al., 2019). Raihan (2024) focusing on the role in fulfilling international climate objectives recommended by UNFCCC, there is intense need of policy restructuring through which agroforestry fully integrate into national climate strategies that enable its mainstream adoption.

Agroforestry systems in Nepal have become an essential strategy for promoting sustainable agriculture, enhancing economic opportunities, and preserving the environment. This integrated land-use approach merges forestry, farming, and livestock management, delivering multiple benefits to rural populations and natural ecosystems. Various forms of agroforestry practiced in Nepal—such as agrisilviculture, agrosilvopastoral systems, and home gardens—not only help farmers diversify their income but also contribute significantly to tackling critical challenges like food insecurity and soil degradation. The incorporation of trees alongside crops improves soil fertility and boosts carbon sequestration (Ghimire et al., 2024). Further, where agriculture dominates livelihoods, agroforestry presents a sustainable approach to addressing rural poverty, food insecurity, and environmental degradation in this country. The need of studying agroforestry as an integrated approach to address the threaten come out as a result of rapid degradation of forest and other land based resources and increasing population pressure over resources that demands for land-use intensification and income diversification (Regmi, 2003).

Agroforestry is increasingly recognized as a vital approach for supporting sustainable livelihoods, particularly in rural settings. Researchers such as Pandit et al. (2013), Khadka et al. (2021), and Poudel et al. (2022), emphasize its contributions to rural development through enhanced income, improved food security, and conservation of biodiversity by fostering harmony between people and nature. In Nepal, where agroforestry is embedded in the socio-economic and ecological fabric, it plays a key role in addressing environmental challenges such as soil erosion, land degradation, biodiversity loss, and climate change. Forests, as an essential component of agroforestry systems, provide natural fertilizers, fodder, and other critical resources for agriculture and environmental health. Poudel et al. (2021) highlighted the economic advantages of improved agroforestry practices mentioning that farmers using improved system significantly increase income and forest product sufficiently compared to traditional practices resulted greater local level impact to the farm household. Ulak et al. (2021) have highlighted emerging commercial interest and diversity in agroforestry across hill and terai regions of Nepal remarkably stressed the ongoing challenges of labour shortages and knowledge gaps seems hindering full potential in the agroforestry sector. Similarly, Dhakal et al. (2022) stated agroforestry as a holistic alternative to conventional farming in Nepal emphasizing its ability to simultaneously address environmental issues, food shortage and other socioeconomic problems which aligns with broader goal of climate and development. Authors further highlighted agroforestry as a resilient path for sustainable development of the country.

Despite its advantages, the widespread adoption of agroforestry in Nepal faces significant obstacles. These include unstable political and economic environments, vague policy frameworks,

low public awareness, and inadequate support from both governmental and private sectors (Khadka et al., 2021; Ghimire et al., 2024). Additionally, ICIMOD (2018) pointed out a lack of sufficient scientific evidence to fully validate agroforestry's role in achieving sustainability. Poudel and Shrestha (2022) stressed emphasizing the integration of livelihood with sustainable land management which needs better policy support, research and development, and extension services to improve and scale agroforestry system throughout South Asian region. This underlines the need to integrate agroforestry into development strategies while preserving traditional crops and farming knowledge.

Given these contrasting views, further investigation is needed to clarify how agroforestry contributes to sustainable livelihoods in rural Nepal. While it shows promise in tackling key issues like climate change, energy security, and water resource management, in-depth research is required to substantiate these claims. In areas with limited alternatives, such as Bethanchowk Rural Municipality in Kavrepalanchok district, targeted studies are essential to evaluate the actual impact of agroforestry. According to Forest Divison Office (2080 BS), most households in the region have significant agroforestry potential, making it a priority area for development research and academic inquiry across rural Nepal. This paper explores that how agroforestry can play constructive role for livelihood sustainability, focusing on its contributions to income, employment, and environmental conservation where subsistence farming used to be absolute source of livelihood in the past.

Methods and Materials

This research paper has employed mixed-methods approach combining qualitative and quantitative data collection and analysis techniques. Overall, the paper composed on descriptive framework being based on the convergent parallel research design. Household surveys, key informant interviews, and field observations provided primary data, while secondary sources included academic journals, government reports, and municipal records. The study sample consisted of 356 agricultural households selected through stratified random sampling whereas 14 key informants covering 2 persons from each 6 ward and 2 more forward farmers are taken for key informant interview. Collected data are processed and analyzed by using basic statistical tools along with SPSS data software for quantitative and MAXQDA for thematic analysis of qualitative data. Overall, this research paper is based on the following conceptual framework demonstrating the relationship among variables:

Figure 1
Conceptual Framework
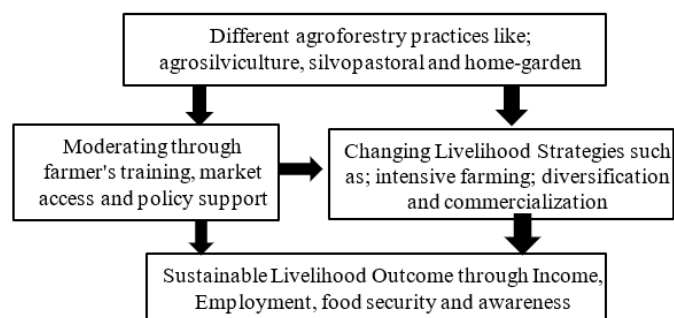
Results
Agroforestry Practices and Trends

Agroforestry in Bethanchwok has transitioned from subsistence farming to commercial-based systems characterized by the integration of trees, crops, and livestock on the same land units. This practice serves multiple functions, including enhancing soil fertility, conserving water, and providing resources such as fuelwood and fodder. It aligns with sustainable land management principles, aiming to improve both environmental health and rural livelihoods. Farmers have adopted agrosilvicultural, agrosilvopastoral, Silvopastoral and home-garden models, promoting biodiversity and productivity. While analyzing the recent trends, the people in the Bethanchowk have increased environmental consciousness, community collaboration, youth involvement and some remarkable technical advancement through improved practices that reflect a gradual shift toward subsistence based to more sustainable and resilient agricultural system in the study area. The major types of agroforestry practiced by the people are shown in the table 1.

Table 1
Types of Agroforestry Practiced by the Respondents

Agroforestry types	Frequency	Percent
Agrosilviculture(crop with tree/plant)	79	22.2
Agrosilvopastoral(Crop, fruits trees & livestock with pasture)	128	36.0
Silvopastoral(Trees, livestock with pasture)	31	8.7
Homegarden (Crops, trees with livestock)	112	31.5
No idea	6	1.7
Total	356	100.0

Source: Field Survey, 2024

Table 1 demonstrate that agrosilvopastoral systems which integrate crops, fruit trees, livestock, and pasture, are the most commonly adopted agroforestry practice accounting for 36.0 per cent followed by homegarden systems covering 31.5 per cent of responses, respectively. This indicates a strong preference for diversified and multifunctional farming systems that offer food, fodder, and income security. However, a few of them actually don't know

that what type of agroforestry they are following.

The occupational status of the people in the study area vary in nature. However, majority of the people are solely depending upon the basic agriculture covering more than two-third of the total whereas very few people are formally engaged in business. The occupational status of the respondents are shown in the table 2.

Table 2
Occupational Status of the Respondents

Main occupation for survival	Frequency	Percent	Cumulative Percent
Daily wage labour	19	5.3	5.3
Basic agriculture	220	61.8	67.1
Commercial agriculture	51	14.3	81.5
Business	23	6.5	87.9
Service or others	43	12.1	100.0
Total	356	100.0	

Source: Field Survey, 2024

Table 2 shows that basic agriculture is the dominant livelihood source, engaging 61.8 per cent of respondents whereas commercial agriculture and service/other sectors follow at 14.3 per cent and 12.1 per cent, respectively. A smaller portion of the people depends on business and daily wage labor covering 6.4 per cent and 5.3 per cent respectively, highlighting a largely agrarian economy with limited diversification in income sources.

Knowledge about agroforestry is fundamental factor that influence people to restructure conventional farming to high yielding farm technique. Nearly two third of the people are well familiar means they are conscious on agroforestry practices and able to make necessary change in their farming pattern which are shown in the table.

Table 3
Level of Knowledge about Agroforestry

Knowledge about agroforestry	Frequency	Percent
Perfectly unknown	1	0.3
Unknown	18	5.1
Neutral	125	35.1
Familiar	203	57.0
Perfectly familiar	9	2.5
Total	356	100.0

Source: Field Survey, 2024

Table 3 indicates that the majority of respondents have some level of awareness about agroforestry, with 57 per cent being familiar and an additional 2.5 per cent perfectly familiar. Around 35.1 per cent remain neutral, suggesting partial or uncertain knowledge. Only a small fraction of 5.4 per cent in total are unaware or perfectly unaware, showing that overall awareness of agroforestry is relatively high in the study area.

In this context one of the key informant, K-3; noted that *there is continue practice of agroforestry even if people do not named it as agroforestry. More interestingly, because of the inception of new technology and skill of management since last 10 years, it has been drastically changed. In recent days, people try to use maximum resource (do not leave for barren) where cutting down unnecessary tree and either harvest commercial plant/trees to use for farming and livestock. Being an owner of successful agricultural form, I truly appreciate the role played by agroforestry in our community.*

People in the Bethnchowk are literally well familiar with agroforestry and have been practicing for long course of time. However, the time duration varies are shown in table 4.

Table 4
Time Duration that Agroforestry Obtained by the Respondent

Agroforestry practice duration	Frequency	Percent
Since few years	58	16.3
5 to 10 years	63	17.7
Above 10 years	130	36.5
No exact ideas	105	29.5
Total	356	100.0

Source: Field Survey, 2024

The table 4 shows that a significant portion of respondents covering 36.5 per cent have been practicing agroforestry for over 10 years, indicating strong long-term engagement whereas some 17.7 per cent have practiced it for 5 to 10 years, and 16.3 per cent for just a few years, reflecting a mix of both experienced and newer adopters. However, 29.5 per cent reported no exact idea about the duration, suggesting gaps in record-keeping or awareness. Overall, the data reflects a growing but uneven familiarity with agroforestry over time.

Agroforestry itself is the integrated approach that combines agriculture with forestry practices making remarkable change in subsistence based farm-practices to livelihood sustainability. Even it become more specific in recent days as a result of changes that are made in contemporary agroforestry to more commercialization. The major changes identified in the field survey are shown in the table 5.

Table 5
Change Made in Agroforestry Practices

Change in Agroforestry	Frequency	Percent
Technical change	22	6.2
Increased Environmental consciousness	173	48.6
Community collaboration	92	25.8
Youth involvement	44	12.4
Others	25	7.0
Total	356	100.0

Source: Field Survey, 2024

Table 5 indicates that the most notable change in agroforestry practices is an increase in environmental consciousness preferred by 48.6 per cent among respondents highlighting growing awareness of sustainability followed by community collaboration by 5.8 per cent whereas youth involvement occupies 12.4 per cent also show positive social shifts. Technical changes remain relatively low suggesting limited innovation adoption. Overall, the changes reflect a strong social and environmental orientation, with room for greater technical advancement in agroforestry.

Being a best alternative of existing farming system, common people believe that agroforestry not only can improve productivity and income of the farmer, but also it holds the most important ecological features relating to biodiversity, soil productivity and climate. The perception of the respondents are shown in the table 6.

Table 6
Perceived Reason for Adapting Agroforestry

Reason behind agroforestry adoption	Frequency	Percent
Improve soil productivity	168	47.2
Enhance biodiversity	40	11.2
Stable climate	47	13.2
Food security and income growth	66	18.5
No clear idea	35	9.8
Total	356	100.0

Source: Field Survey, 2024

The table 6 reveals that the primary perception driving agroforestry adoption is its ability to improve soil productivity prefered by 47.2 per cent of the respondents, followed by its role in enhancing food security and income for 18.5 per cent of them. Smaller percentages recognize its contribution to climate stability and biodiversity enhancement. About 9.8 per cent have no clear idea, indicating a need for greater awareness. Overall, productivity and livelihood benefits are the key motivators for agroforestry adoption. Realizing its importance, K-4 argued that, *agroforestry make our life easy by supporting agriculture and forestry each other. We can have formal income by selling extra products. Livelihood become comfortable through agroforestry.*

Food security is one of the fundamental advantage due to which people are favoring agroforestry in most of the rural areas of Nepal where farmland exist or surrounded with forest components. Realizing this fact, people preferring to execute agriculture and forestry jointly for long-term benefits that are shown in the table 7.

Table 7
Perception on Agroforestry to Increased Food Security

	Frequency	Percent
Strongly disagree	4	1.1
Disagree	24	6.7
Neither agree nor disagree	65	18.3
Agree	200	56.2
Strongly agree	63	17.7
Total	356	100.0

Source: Field Survey, 2024

The data in table 7 shows that near three-quarter of the respondents have a positive attitude, with 56.2 per cent agreed and 17.7 per cent strongly agreed, totaling nearly 74 per cent support. Only 7.8 per cent expressed disagreement, while 18.3 per cent remained neutral. This indicates a strong overall approval or agreement with the statement or issue being evaluated. Overall, the data indicates widespread agreement and support among respondents, reinforcing the perceived relevance or benefit of the subject being assessed.

People in Bethanchowk have understood physical as well as financial outcome of agroforestry through different income generating practices such as multiple cropping of annual aggregate growth in household income. The perceived role are shown in the table 8.

Table 8
Perceived Role of Agroforestry for Income Generation

Income generating role of agroforestry	Frequency	Percent	Cumulative Percent
Possibility of multiple cropping	22	6.2	6.2
Prospect of annual income growth	103	28.9	35.1
Due to regular earning source	33	9.3	44.4
Practicing Animal husbandry with farming	198	55.6	100.0
Total	356	100.0	

Source: Field Survey, 2024

Table 8 shows that the more than half of the respondents view agroforestry's income-generating role primarily through the joint practice of animal husbandry and farming. This is followed by the prospect of annual income growth by 28.9 per cent of the respondents. Only a small portion emphasized the role of multiple cropping to generate regular income. This suggests that integrated farming systems, especially those combining livestock and crops, are seen as the most effective and reliable means of income through agroforestry. The conclusion points to the significance of diversified practices in enhancing rural household incomes. One of the key informants K-12 stated that, *whatever income we have made are the best possible outcome of agroforestry in this region. It easily provides organic fertilizer which induce production, increase income and reduces everyday expenses for consumption and production that eventually ensure food security.*

Income is said to be central focus of every development goal through which rest of the other livelihood components can be achieved. With the adoption of agroforestry, people truly realized the remarkable change in aggregate income that can be shown in the table 9.

Table 9
Percentage Change in Income After Adapting Agroforestry

Aggregate income change	Frequency	percent
No change	8	2.2
Less than 25 per cent	86	24.2
25-50 per cent	124	34.8
50-75 per cent	66	18.5
75 per cent or above	72	20.2
Total	356	100.0

Source: Field Survey, 2024

The table shows the perceived level of change due to agroforestry practices. A significant portion of respondents (34.8 per cent) reported a 25–50 percent change, followed by 20.2 per cent noting 75 percent or more change, and 18.5 per cent indicating a 50–75 percent change. Only 2.2 per cent observed no change at all. Overall, the data suggests that the majority of respondents experienced moderate to high positive changes, reflecting the substantial impact of agroforestry on their livelihoods.

There are many reasons due to which people thought that agroforestry in suitable alternative at Bethanchowk. Some argued that it improve soil productivity whereas some focused for stable income and food security. However, some of the respondents still don't know that whether it is due to agroforestry or others, which are reflected in the table 10.

Table 10
Important Reasons to Adapt Agroforestry in Bethanchowk

Major reasons	Frequency	Percent
Improve soil productivity	168	47.2
Enhance biodiversity	40	11.2
Stable climate	47	13.2
Food security and income growth	66	18.5
No clear idea	35	9.8
Total	356	100.0

Source: Field Survey, 2024

Table 10 illustrates the major reasons behind agroforestry adoption among respondents. Improving soil productivity is the most cited reason, accounting for 47.2 per cent of responses, indicating a strong recognition of agroforestry's role in enhancing land quality. Food security and income growth follow at 18.5 per cent, reflecting its livelihood benefits. A smaller portion of respondents identified climate stability and biodiversity enhancement by 13.2 per cent and 11.2 per cent respectively as key motivations. Notably, 9.8 per cent of respondents had no clear idea, suggesting the need for greater awareness. Overall, the data highlights that environmental and economic benefits are the primary drivers of agroforestry adoption in the study area.

Table 11
Contribution of Agroforestry in Family Income and Allied Sector

Major contribution	Frequency	Percent
Income diversified	81	22.8
Food security	84	23.6
Increase employment	79	22.2
Increase land productivity	78	21.9
Reduced cost of production	32	9.0
No idea	2	.6
Total	356	100.0

Source: Field Survey, 2024

The table presents respondents' views on the major contributions of agroforestry to their livelihoods. The responses are fairly evenly distributed across the top four categories: food security by 23.6 per cent, income diversification by 22.8 per cent, increased employment by 22.2 per cent, and increased land productivity by 21.9 per cent of the respondents. This indicates that agroforestry is perceived as a multi-dimensional strategy, contributing simultaneously to economic stability, job creation, and agricultural productivity. However, only 9 per cent cited reduced cost of production, suggesting that while agroforestry offers several benefits, it may not significantly lower input costs or that such benefits are less recognized. The negligible percentage of respondents with no idea (0.6 per cent) reflects a high level of awareness and engagement with agroforestry practices. Overall, the table shows that agroforestry is broadly valued for enhancing both livelihood and agricultural outcomes, though cost reduction is a less emphasized benefit.

Figure 2
Agroforestry Word cloud Formated with MAXQDA

The word cloud in the figure 2 demonstrate the centralized focuses to agroforestry by all most key informants along with other livelihood related issues. Being core of the concepts each of the participants highlighted with its positive as well as negative outcomes. However, positive arguments outnumbered the negative effects.

Contribution to Livelihoods

Agroforestry has significantly improved household income, with many farmers diversifying their economic activities. The study found a positive correlation between agroforestry adoption and livelihood resilience, with enhanced food security and employment opportunities.

Table 12
Perceived Contributions of Agroforestry to Livelihood Sustainability

Livelihood Benefit Area	Frequency	Percentage
Reduction in soil erosion	224	62.92
Promotion of environmental stability	207	58.15
Improved knowledge sharing and empowerment	206	57.86
Contribution to household food security	200	56.18
Protection of water resources	190	53.37
Decline in dependency on external resources	184	51.68
Reduction of environmental risks	144	40.44
Enhancement of household income	136	38.20

Source: Field Survey, 2024

The table highlights key livelihood benefits associated with agroforestry as perceived by respondents. The most acknowledged benefit is the reduction in soil erosion by 62.92 per cent, followed closely by the promotion of environmental stability by 58.15 per cent and improved knowledge sharing and empowerment to 57.86 per cent. Contributions to food security preferred by 56.18 per cent and water resource protection by 53.37 per cent of the respondents also rank high, indicating strong recognition of agroforestry's environmental and socio-economic impacts. While over half of respondents acknowledged reduced dependency on external resources whereas fewer linked agroforestry to reduced environmental risks (40.44 per cent) and increased household income to 38.20 per cent. This suggests that while environmental and community benefits are widely appreciated, economic gains are comparatively under-recognized, pointing to the need for stronger market integration and income-focused interventions.

Agroforestry mitigates climate change effects by reducing soil erosion, enhancing water retention, and sequestering carbon. Additionally, it fosters social cohesion by strengthening community-based resource management practices.

Table 13
Ecological Contribution of Agroforestry

Perception of the respondents	Soil fertility and water retention		Reduce environmental extreme (Drought & flood)		Reduce erosion and biodiversity support	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly disagree	2	.6	8	2.2	5	1.4
Disagree	7	2.0	21	5.9	11	3.1
Neutral	30	8.4	112	31.5	40	11.2
Agree	190	53.4	144	40.4	224	62.9
Strongly agree	127	35.7	71	19.9	76	21.3
Total	356	100.0	356	100.0	356	100.0

Source: Field Survey, 2024

Table 13 presents respondents' perceptions of agroforestry's role in three key areas: soil fertility and water retention, reducing environmental extremes (like drought and floods), and controlling erosion

while supporting biodiversity. A strong majority agree or strongly agree that agroforestry contributes positively in all three areas—89.1 per cent for soil fertility and water retention, 60.3 per cent for reducing environmental extremes, and 84.2 per cent for erosion control and biodiversity support. Neutral responses are highest (31.5 per cent) in the case of environmental extremes, suggesting some uncertainty or lack of clear evidence among respondents in that specific area. Negative perceptions (disagree and strongly disagree) remain very low across all indicators. One of the key informants who is operating a successful agricultural form K-13 noted "*all our available lands are better utilized through agroforestry. Plain field are used for cropping where sloppy field and edge of the cropland are full of different useful trees and shrubs. That jointly contribute for better employment, income as well as protection from possible disaster and hence copping with environmental challenges.*"

Discussion

The study reveals that agroforestry in Bethanchowk has undergone a clear transition from subsistence-based practices to diversified, multifunctional systems integrating trees, crops, and livestock. Agrosilvopastoral and homegarden systems are most widely adopted, reflecting a preference for resource-efficient land use that supports both household subsistence and commercial goals. This transition is supported by increased environmental consciousness, growing youth engagement, and community collaboration align with the findings of Dhakal er al. (2022) & Ghimire et al. (2024), indicating a broader social shift toward sustainability

Most households rely on basic agriculture for their livelihood, yet a significant portion also practices commercial agriculture, demonstrating a trend toward income diversification. Such livelihood strategy has also supported by Poudel et al. (2021) findings. High familiarity with agroforestry practices among about 60 per cent respondents suggests that awareness programs and experiential learning are having a positive impact which is consistent with the findings of Khadka et al. (2021). Long-term engagement, particularly by those practicing agroforestry for more than a decade, has likely reinforced this familiarity.

Improving soil productivity stands out as the primary motivation for adopting agroforestry to nearly half of the respondents, followed by food security and income growth. These align with reported perceptions of agroforestry's capacity to increase household income, most notably through integrated animal husbandry and enhance livelihood resilience which are closely reflect the findings by Duffy et al. (2021) & Raihan (2024). Over one-third of respondents reported a 25–50 per cent increase in income after adopting agroforestry, confirming its positive economic impact

which is strongly supported by Ghimire et al. (2024) findings connecting forestry, farming and livestock accommodating multiple streams of income.

Despite the ecological and economic benefits, technical innovation adoption remains low, indicating a need for improved extension services and access to appropriate technologies. This findings reflects the challenges pinted out by Ulak et al. (2021), who mentioned about labour shortage, land fragmentation, and knowledge gaps look significant obstacles to hinder realizing full potential of agroforestry. Nevertheless, perceived benefits of agroforestry extend beyond income, including improved soil conservation, environmental stability, and food security that are shown in table 12 are closely associated the findings of Bansal et al. (2021) & Dhakal et al. (2022). Anyways, majority of respondents agreed or strongly agreed that agroforestry enhances soil fertility, mitigates climate risks, and supports biodiversity.

Overall, the findings suggest that agroforestry serves as a holistic approach to sustainable land management and livelihood improvement in Bethanchowk. It contributes to ecological resilience while offering tangible socio-economic benefits which reflects agroforestry as a better measure to transform subsistence based livelihood to sustainability

However, as per the arguments put forwarded by Khadka et al. (2021) & Poudel & Shrestha (2022), for the realization of its full potential, further emphasis on market integration, value chain development, and technical capacity-building is essential.

Conclusion

This study underscores the importance of agroforestry in promoting sustainable livelihoods in rural hill regions of Nepal. Given the strong reliance on agriculture and forestry, agroforestry is seen as a key approach to enhancing economic resilience, environmental health, and social progress in line with global development goals. Common models like agrosilvopastoral systems and home gardens contribute to income diversification, food security, and ecological balance. Participants highlighted benefits such as improved soil fertility, water management, and disaster risk reduction, while also noting the need for stronger policy support and community involvement. The study presents agroforestry as a transformative tool for shifting rural communities from subsistence to diversified and resilient livelihoods. By blending traditional knowledge with scientific approaches, it offers a viable solution to rural poverty, environmental degradation, and climate challenges, emphasizing the need for collaborative, multi-stakeholder efforts in the promotion of agroforestry.

References

Adhikari, S., Ghimire, S. & Paneru, S. (2018). Resilence in agricultural productivity through agroforestry: Possible contribution to food security in Nepal. *Journal of Pharmacoghosy and Phytochemestry.* 2138-2141. www.phytojournal.com

Amatya, S. M., Cedamon, E., & Nuberg, I. (2018). *Agroforestry system and practices in Nepal (Revised Edition).* Agriculture and Forestry University of Nepal.

Bansal, V., Joshi, V., & Meena, S. C. (2021). Agroforestry for sustainable rural livelihood: A review. *Turkish Online Journal of Qualitative Inquiry*, *12*(10).

Dhakal, A., Maraseni, T.N., Timsina, J. (2022). Assessing the potential of agroforestry in Nepal: Socio-economic and environmental perspectives. In: Timsina, J., Maraseni, T.N., Gauchan, D., Adhikari, J., Ojha, H. (eds) *Agriculture, Natural Resources and Food Security. Sustainable Development Goals Series*. Springer. https://doi.org/10.1007/978-3-031-09555-9_21

Forest Division Office, (2080 BS). *Monitoring and evaluation book of community and leasehold forest users groups*. Forest Division Office, Kavrepalanchok.

Duffy, C., Toth, G. G., Hagan, R. P., McKeown, P. C., Rahman, S. A., Widyaningsih, Y., ... & Spillane, C. (2021). Agroforestry contributions to smallholder farmer food security in Indonesia. *Agroforestry Systems*, *95*(6), 1109-1124. https://doi.org/10.1007/s10457-021-00632-8

FAO & ICRAF. (2019). Agroforestry and tenure. *Forestry Working Paper no. 8.* https://openknowledge.fao.org/handle/20.500.14283/ca4662en

Ghimire, M., Khanal, A., Bhatt, D., Dahal, D., & Giri, S. (2024). Agroforestry systems in Nepal: Enhancing food security and rural livelihoods–a comprehensive review. *Food and Energy Security*, *13*(1), e524. https://doi.org/10.1002/fes3.524

ICIMOD. (2018 April 27-29). *Role of agroforestry and traditional crops in livelihoods in the Hindu Kush Himalaya.* International agroforestry conference, Kathmandu. https://creativecommons.org/licenses/by-nc-nd/4.0/

Khadka, D., Aryal, A., Bhatta, K.P., Dhakal, B.P. & Baral, H. (2021). Agroforestry systems and their contribution to supplying forest products to communities in the Chure range, central Nepal. *Forests 2021*, *12*, 358. https://doi.org/10.3390/f12030358

Khatri, B. B., & Timsina, T. R. (2023). Status of agricultural stagnation in Nepalese economy: A descriptive analysis. *NUTA Journal, 10*(1-2), 1-14. https://doi.org/10.3126/nutaj.v10i1-2.62827

Miller, D. C., Ordoñez, P. J., Brown, S. E., Forrest, S., Nava, N. J., Hughes, K., & Baylis, K. (2019). The impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in low-and middle-income countries: An evidence and gap map. *Campbell Systematic Reviews*, *16*(1), e1066.

Mukhlis, I.; Rizaludin, M.S.; Hidayah, I. (2022). Understanding socio-economic and environmental impacts of agroforestry on rural communities. *Forests.* 13, 556. https://doi.org/10.3390/f13040556

Pandit, B.H., Shrestha, K.K., & Bhattarai, S. (2014). *Conservation and livelihood impacts of agroforestry system: A case study of Kavrepalanchok district of Nepal*. https://shorturl.at/rc8IB

Pandit, N. R., Gautam, D., & Adhikari, S. (2013). Role of agroforestry practices in changing rural livelihood economy: case study of Dhaibung VDc of Rasuwa district. *The Initiation*, *5*, 32-42.

Paudel, D., Tiwari, K. R., Raut, N., Bajracharya, R. M., Bhattarai, S., Sitaula, B. K., & Thapa, S. (2022). What affects farmers in choosing better agroforestry practice as a strategy of climate change adaptation? An experience from the mid-hills of Nepal. *Heliyon*, *8*(6). https://doi.org/10.1016/j.heliyon.2022.e09695

Paudel, D., Tiwari, K. R., Raut, N., Sitaula, B. K., Bhattarai, S., Timilsina, Y. P., & Thapa, S. (2021). Which agroforestry practice is beneficial? A comparative assessment of the traditional and the improved agroforestry techniques in the Midhills of Nepal. *Advances in Agriculture*, *2021*(1), 2918410. https://doi.org/10.1155/2021/2918410

Paudel, Y., & Shrestha, S. (2022). Agroforestry practices prevailing in SAARC countries: A review. *Indonesian Journal of Social and Environmental Issues (IJSEI)*, *3*(1), 10-18. https://doi.org/10.47540/ijsei.v3i1.390

Raihan, A. (2024). The potential of agroforestry in South Asian countries towards achieving the climate goals. *Asian Journal of Forestry*, *8*(1). https://doi:10.13057/asianjfor/r080101

Regmi, B. N. (2003, May). Contribution of agroforestry for rural livelihoods: A case of Dhading District, Nepal. In *International conference on rural livelihoods, forests and biodiversity* (pp. 19-23).

Tiwari, P., Kumar, R., Thakur, L. and Salve, A. (2017). Agroforestry for sustainable rural livelihood: A review, *International Journal of Pure and Applied Bioscience.* 5(1): 299-309 doi: http://dx.doi.org/10.18782/2320- 7051.2439

Ulak, S., Lama, B., Pradhan, D. K., & Bhattarai, S. (2021). Exploring agroforestry systems and practices in the Terai and hill regions of Nepal. *Banko Janakari*, *31*(2), 3-12. https://doi.org/10.3126/banko.v31i2.41885.