

**CONTRIBUTION OF AGRO FORESTRY TO SUSTAINABLE LIVELIHOODS IN
BETHANCHWOK RURAL MUNICIPALITY, KAVREPALANCHOK, NEPAL**

A Dissertation

**Submitted to the Central Department of Rural Development, Faculty of
Humanities and Social Sciences, Tribhuvan University, Nepal**

**In partial fulfillment of the requirement for the
Degree of Masters of Philosophy (MPhil)**

**In
Rural Development**

Submitted By: Tirtha Raj Timsina

MPhil/ PhD:Batch 2023

Roll no.: 2830055

TU Registration no.: 6-1-218-518-97

**Central Department of Rural Development,
Tribhuvan University, Nepal**

December 2024

DECLARATION

I, *Tirtha Raj Timsina* declare that this dissertation entitled “**Contribution of Agro forestry to sustainable Livelihood in Bethanchwok Rural Municipality, Kavrepalanchok, Nepal**” submitted to Central Department of Rural Development, TU, Kirtipur is my own original work unless otherwise indicated or acknowledged in the dissertation. The dissertation does not contain materials which has been accepted or submitted for any other degree at the University or any other institution. All sources of information have been specifically acknowledged by proper citation and reference to the author(s) or institution(s). Therefore, I formally declare that this research works strictly follow true academic integrity and scientific rigor.

.....

Tirtha Raj Timsina

MPhil/PhD (Batch 2023)

Roll no.: 2830055

Date: 2081-08-23

(2024-12-08)

RECOMMENDATION LETTER

The MPhil dissertation entitled “**Contribution of Agro forestry to sustainable Livelihood in Bethanchwok Rural Municipality, Kavrepalanchok, Nepal**” has been prepared by **Mr. Tirtha Raj Timsina** under my guidance and supervise on. I, hereby, recommend it in partial fulfillment of the requirements for the Degree of Masters of Philosophy (MPhil) in Rural Development for final examination.

.....

Prof. Kanhaiya Sapkota, PhD

Dissertation Supervisor

Date: 2081-08-28

(2024-12-13)

APPROVAL SHEET

We certify that this dissertation entitled, “**Contribution of Agroforestry to sustainable Livelihood in Bethanchwok Rural Municipality, Kavrepalanchok, Nepal**” submitted by **Mr. Tirtha Raj Timsinain** partial fulfillment of the requirements for the Degree of Masters of Philosophy (MPhil) in Rural Development has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the said degree.

Evaluation Committee

Assoc. Prof. Bishnu Bahadur Khatri

Head of the Department

Prof. Kanhaiya Sapkota, PhD

Dissertation Supervisor

Assoc. Prof. Raghu Bir Bista, PhD

Internal Examiner

Prof. Uma Kanta Silwal, PhD

External Examiner

Date: 2081-09-25

(2025-12-08)

SELF DECLARATION

Date: 2081-10-11

To, Head of the Department
Central Department of Rural Development
TU, Kirtipur.

Subject: Self-Declaration

Dear sir/madam,

I hereby affirm that there exists no disparity in the substance of the physical print and digital version of the document specified below, which has been submitted to this establishment for the purpose of undergoing a plagiarism examination. If any dissimilarity is discovered between the physical print and digital version, I am prepared to accept any consequences as per the established regulation.

Details:

Author Name : Mr. Tirtha Raj Timsina
Document Title : **Contribution of Agroforestry to Sustainable Livelihood in
Bethanchwok Rural Municipality, Kavrepalanchok, Nepal**
Academic Level : Master of Philosophy (MPhil)
Document Type : Dissertation
Submitted to : Central Department of Rural Development
Mobile no. : 9852061122
Email : tirtha.timalsina@bkmc.tu.edu.np
Signature :

PLAGIARISM TEST REPORT

ACKNOWLEDGEMENTS

I express my warm gratitude to Prof. Dr. Kanhaiya Sapkota for his invaluable inspiration, supervision and guidance as my supervisor. His academic insight, intellectual support, and generous investment of time made this research work possible in time. I would also like to extend my sincere thanks to the Head of the Department, Assoc. Prof. Bishnu Bahadur Khatri for his insightful thought and inspiration as a guardian of my academic journey. Likewise, I would like to acknowledge internal examiner Dr. Raghu Bir Bista, for his insightful comments throughout the entire dissertation. Similarly, I am also deeply indebted with external examiner and my *Guru* Prof. Dr. Uma Kanta Silwal, for his inspiration and feedback and all the faculty members and administrative staff for their support during my time at the Central Department of Rural Development.

I am deeply grateful and my sincere thanks to Mr. Dashram Gorkhali, an engineer of Bethanchowk Rural Municipality and the MARD students of Bhaktapur Multiple campus, who has provided me countless supports during the time of data collection without whom my field work would have been impossible where devastating landslides had taken place. I also extend my sincere thanks to Mr. Bhagwan Adhikari, Chairman of Bethanchowk, Mr. Madhusudhan Dahal, Sangita Shrestha, Pabitra Ji, Gokul Ji and other persons along with all the research participants who have helped me during the time of data collection and field work. Similarly,

At last but not the least, I am indebted to my wife Sushma Baral, my two naughty kids, Sutikshna and Shivansh Timsina and my innocent mother, Sarita Timsina, mother in law, Sharada Baral along with other family member for their constant support and being there in every steps of my life. I also salute the compassion and support of my late father for giving me that shape of life.

ABSTRACT

This study investigates the contribution of agro forestry in promoting sustainable livelihoods in Bethanchwok Rural Municipality, Kavrepalanchok District, Nepal. This research is based on the pragmatist philosophical view point that utilize a convergent mixed-method approach, data were collected from household surveys, key informant interviews, and field observations which are supported by secondary sources such as scholarly publications, governmental and municipal records. Considering entire municipality as a study universe, a total of 356 sample were selected employing stratified sampling technique to cover the different areas of the selected study area whereas 14 key informants were purposively selected covering the commercial farm producers, agribusiness, local representative and intensive farmers. The research identifies agro forestry as a transformative practice that shifts from subsistence-based to commercially oriented systems, enhancing food security, income diversification, and environmental conservation. Key findings highlight the diverse benefits of agro forestry, including its contribution to soil conservation, biodiversity, and resilience to climate-induced challenges. However, challenges such as inadequate policies, limited market access, and insufficient local governance were identified as significant barriers to its full potential.

The study employs the Sustainable Livelihoods Framework to analyze agro forestry's impacts on various livelihood assets, including natural, social, financial, and human capital. Integration of forestry and agriculture jointly fosters diversified income opportunities, enhances productivity, and mitigates environmental risks through agro forestry. This research recommends policy reforms to address market and governance gaps, capacity-building initiatives for local farmers, and investment in infrastructure to facilitate commercial agro forestry. The research concludes that agro forestry is indispensable for sustainable rural development in Nepal, aligning with broader goals of environmental sustainability and economic resilience. It emphasizes the importance of participatory approaches, aligning local practices with scientific innovations to maximize agro forestry's potential.

Key Words: Agroforestry, sustainable livelihoods, Bethanchwok, income diversification, food security, climate resilience.

TABLE OF CONTENTS

DECLARATION	II
RECOMMENDATION LETTER	
ERROR! BOOKMARK NOT DEFINED.	
APPROVAL SHEET	IV
SELF DECLARATION	V
PLAGIARISM TEST REPORT	VI
ACKNOWLEDGEMENTS	VI
ABSTRACT	VII
TABLE OF CONTENTS	VIII
LIST OF TABLES	XI
LIST OF FIGURES	XIV
ABBREVIATION/ACRONYMS	XIV
CHAPTER - I: INTRODUCTION	1
1.1 Background of the Study	1
1.2 Statement of the Problem	3
1.3. Research Questions	4
1.4 Objectives of the Study	4
1.5 Significance of the Study	5
1.6 Scope and Delimitations of the Study	5
1.7 Operational Definition to Term Used	5
1.8 Organization of the Study	8
CHAPTER - II: LITERATURE REVIEW	9
2.1 Conceptual Review	9
2.2 Theoretical Review	11
2.3 Empirical Review	13
2.4 Policy Review	20
2.5 Methodological Review	24
2.6 Summary of the Literature Review	25
2.7 Research Gap	26
2.8 Theoretical and Conceptual Framework	26
CHAPTER - III: RESEARCH METHODOLOGY	30
3.1 Philosophical Standpoint	30

3.2 Research Design	30
3.3 Rational of the Study Area Selection	31
3.4 Nature and Sources of Data	31
3.5 Universe, Sampling Procedure and Sample Size	32
3.6 Data Collection Method, Techniques and Tools	33
3.7 Reliability and Validity	33
3.8 Methods of Data Analysis and Interpretation	34
3.9 Ethical Consideration	34
3.10 Novelty and Contribution of the Study in Disciplinary Area	35
CHAPTER - IV: DATA ANALYSIS AND INTERPRETATION	36
4.1 Introduction of the Study Area	36
4.1.1 Caste distribution	39
4.1.2 Agricultural status	40
4.1.3 Occupational status	41
4.1.4 Nature of agricultural practice	42
4.2 Patterns and Trends of Agroforestry Practices	42
4.2.1 Age and sex-based distribution of the participants	43
4.2.2 Caste/Ethnic categories with agroforestry practice	44
4.2.3 Education level and agroforestry knowledge	45
4.2.4 Survival occupation and agroforestry knowledge	47
4.2.5 Source of agroforestry idea and its knowledge level	48
4.2.6 Agroforestry practice duration and its major changes	50
4.2.7 Types of agroforestry practices along with types of trees in farming	52
4.2.8 Status of agroforestry practice change over time	53
4.2.9 Nature of change with adopting agroforestry	54
4.2.10 Reason behind practicing agroforestry	55
4.3 Role of Agroforestry in Changing Rural Livelihood	57
4.3.1 Contribution of agroforestry as family income sources	58
4.3.2 Additional advantage served by agroforestry	59
4.3.3 Physical and financial support obtained for agroforestry	60
4.3.4 Perception on the role of agroforestry in avoiding crisis	61
4.3.5 Perception regarding the role of agroforestry to strengthen rural livelihood	62
4.3.6 Role of agroforestry for controlling soil erosion, flood and landslides	63

4.3.7 Perception regarding productivity role of agroforestry	64
4.3.8 Responsibility to promote agroforestry practices to reduce crisis	66
4.3.9 Relationship between change in agroforestry and agricultural productivity	67
4.3.10 Support obtained and productivity growth by agroforestry	68
4.4 Agroforestry System in Achieving Sustainable Livelihood	70
4.4.1 Sustainability components of rural livelihood	70
4.4.2 Agroforestry as an appropriate means for livelihood sustainability	70
4.4.3 Reason behind the growth in family income through agroforestry	72
4.4.4 Agroforestry for maintaining food security	73
4.4.5 Agroforestry to reduce soil erosion and support biodiversity	74
4.4.6 Agroforestry for environmental challenges like drought, flood and storm	75
4.4.7 Reduction in farming production costs and dependencies outside	76
4.4.8 Agroforestry for soil fertility and water source retention	77
4.4.9 Agroforestry to maintain long term ecological stability	78
4.4.10 Social contribution of agroforestry for knowledge and social empowerment	80
4.4.11 Common perception on agroforestry that ensure sustainable livelihood	81
CHAPTER - V: SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS	83
5.1 Summary of the Findings	83
5.2 Conclusion	84
5.3.1 General recommendations:	85
5.3.2 Policy recommendations:	85
5.3.3 Knowledge contribution:	86
5.3.4 Areas for further research:	86
REFERENCES	87
APPENDIX-1	95
APPENDIX-2	100
ANNEX - 1	101

LIST OF TABLES

Table 3.1: Ward-wise agricultural household and respective sample taken	33
Table 4.1: Ward-wise population distribution of Bethanchowk RM	37
Table 4.2: Caste-wise distribution of Household	39
Table 4.3: Ward-wise agricultural status of Bethanchowk RM	40
Table 4.4: Occupational distribution of the population in Bethanchowk RM	41
Table 4.5: Status of agricultural population in Bethanchowk RM	42
Table 4.6: Age and Sex distribution of the participants	43
Table 4.7: Caste/Ethnic categories with agro forestry practice duration	45
Table 4.8: Education level and knowledge of agro forestry	46
Table 4.9: Main occupation for survival and agroforestry knowledge	47
Table 4.10: Idea of agro forestry and its knowledge strength	49
Table 4.11: Agro forestry practices duration and major changes	51
Table 4.12: Agroforestry types and types of tree planted	52
Table 4.13: Change in agro forestry over time	54
Table 4.14: Percentile change in income after adapting agro forestry	55
Table 4.15 Reason behind adapting agro forestry	56
Table 4.16: Contribution of agro forestry in household	59
Table 4.17: Benefits obtained from agro forestry	60
Table 4.18: Support for agro forestry with supporting authority	61
Table 4.19: Agro forestry to improve resilience on economic & environmental shocks	62
Table 4.20: Perception regarding the role of agro forestry to strengthen rural ...	63
Table 4.21: Agro forestry to protect from soil erosion, flooding, or landslides	64
Table 4.22 a: Improvement in farm productivity by agro forestry	65
Table 4.22 b: Correlations between agro forestry knowledge and farm productivity	65

Table 4.23: Responsible authority to promote agro forestry and reduce vulnerabilities	66
Table 4.24: Change in agro forestry with Improvement in farm productivity	67
Table 4.25: Supporting authority for agro forestry and response on	69
Table 4.26: Agro forestry for livelihood sustainability with main occupation for.....	71
Table 4.27: Reason to increase family income in Bethanchowk	73
Table 4.28: Arguments regarding agro forestry for food security	74
Table 4.29: Response regarding the role of agro forestry to reduce soil	75
Table 4.30: Agro forestry to reduce environmental extremes like; drought, floods	76
Table 4.31: Agro forestry to reduce farmer's dependencies and production costs	77
Table 4.32: Agro forestry as a means to protect soil fertility and water sources	78
Table 4.33 a: Agro forestry for long term ecological stability	79
Table 4.33 b: Correlation between agro forestry knowledge and its role on long	79
Table 4.34: Social contribution of agro forestry for knowledge sharing	80
Table 4.35: Common perception of agro forestry to ensure sustainable livelihood	81

LIST OF FIGURES

Figure 2.1: Conceptual framework for agro forestry analysis	28
Figure 3.1: The convergent parallel research design	31
Figure 4.1: Politico-administrative map of Bethanchowk	38
Figure 4.2: Land use map of Bethanchowk	38
Figure 4.3: Age and sex distribution of the participation	44
Figure 4.4: Educational level and knowledge on agro forestry	46
Figure 4.5: Main source of occupation and agro forestry knowledge	48
Figure 4.6: Knowledge level and idea of agro forestry obtained	50
Figure 4.7: Agro forestry practice duration and major changes	51
Figure 4.8: Agro forestry type with major type of trees	53
Figure 4.9: Major reasons of practicing agro forestry	57
Figure 4.10: Commonness of agro forestry as a core issue of livelihood	58
Figure 4.11: Improvement in farm productivity through agro forestry change	68
Figure 4.12: Improving farm productivity with supporting authority to agro forestry	69
Figure 4.13: Appropriateness of agro forestry with main source of occupation	72

ABBREVIATION/ACRONYMS

ANSAB	: Asia Network for Sustainable Agriculture and Bio-resources
CFUG	:Community Forestry Users Group
DFID	: Department of International Development
GDP	: Gross Domestic Product
ICIMOD	: International Centre for Integrated Mountain Development
MARD	: Masters of Arts in Rural Development
MoALD	: Ministry of Agriculture and Livestock Development
NTFP	: Non Timber Forest Product
RM	: Rural Municipality
SDG	: Sustainable Development Goals
SLF	: Sustainable Livelihood Framework
UCRAF	: International Centre for Research in Agro forestry

CHAPTER - I

INTRODUCTION

1.1 Background of the Study

Agro forestry an integrated system of combining agriculture livestock farming and forest activities on the same unit of land, is a time-tested livelihood strategy in many rural economies (Ministry of Agriculture and Livestock Development, 2019). Despite its potential to address food security, climate resilience and environmental conservation, agro forestry in Nepal has not yet been fully optimized for sustainable development. The limited adaption of scientific approaches and the lack of effective policy implementation have resulted in continued reliance on traditional/indigenous practices placing pressure on natural forests and contributing to food insecurities and environmental degradation (Khadka et al., 2021). This study seeks to explore the role of agro forestry in enhancing livelihoods and promoting sustainability in Nepal with a specific focus on Bethanchowk Rural Municipality in Kavrepalanchok district.

Agro forestry is recognized globally as a cost effective strategy for climate change mitigation and a contributor to socio-economic and environmental sustainability. It fosters food security, income generation and biodiversity conservation while reducing greenhouse gas emissions through carbon sequestration (Mbow et al., 2014, FAO & ICRAF, 2019). Nepal, where agriculture accounts for 24 per cent of GDP but supports two-thirds of the population, faces critical challenges of food security, natural disaster and rural poverty (Ministry of Finance, 2023). Integrating forestry with agriculture through scientifically driven agro forestry practices offers a viable solution to these challenges. The National Forest Sector Strategy of Nepal underscores the need for sustainable forest management and the optimization of forest ecosystem for national prosperity (Ministry of Forest and Soil Conservation, 2016). However, current efforts remain inadequate, emphasizing the urgency for research on agro forestry's potential to address these issues.

The widespread benefits of agro forestry such as economic, environmental and social have been well documented. For instance, it enhances food security through fodder shrubs boosting milk production and indigenous fruit-trees while improving soil fertility with "fertilizer trees" that eventually induce crop production (Kiptot et al., 2014). It also aids in biodiversity conservation and rural job creation (Miller et al., 2019). However, gaps remain in understanding the complexities of agro forestry landscapes across

different biophysical, socio-economic and governance contexts (Elbakidze et al., 2021). In Nepal, scientific innovation in agro forestry have not been adequately adopted and extension services and market development for agro forestry products are insufficient (Timalsina, 2019; Khadka et al., 2021).

This study aims to address these gaps by examining the interplay of agro forestry practices, policies and outcomes in the local context of Bethanchowk Rural Municipality. The greater significance of such integration help reduces the risk of crop failure even in an adverse condition like; prolong drought and different natural calamities caused by climate change (Sahoo & Wani, 2020). In such context, this study can be significant in addressing some of the following issues which are identified by FAO & ICRAF (2019). They are:

-) Agro forestry as a Sustainable Livelihood Strategy
-) Integration of Scientific Innovations
-) Policy, Extension Services, and Market Systems:
-) Support for S DGs including eradicating hunger, reducing poverty, promoting gender equality and combating climate change.

To daro and Smith (2003), pointed out that, transforming a traditional agrarian system to the diversified or mixed farming represents a logical intermediation to specialized production where new cash crops such as fruits, vegetables, coffee, tea etc. are established, together with simple animal husbandry. It is viewed that agro forestry is considered to play crucial role not only reducing vulnerability and climate related risk but also increasing resilience of farming system (IC MOOD, 2018). So, the concept of agro forestry composed by the mixture of agriculture with the forest and forest product by which both of the sectors could contribute for mutual benefits.

In general, there exist two diverse practices of agro forestry, namely traditional and the improved. Traditional is composed with the farmers practice of woody perennial in alley of farmland in order to fulfill the subsistence needs of forest products whereas improved practice, farmer grows perennial, fruits and cash crops along with agricultural crop for commercial purpose too (Paddle et al., 2021). The widespread benefits of agro

forestry are related to the all aspects of sustainability such as; economic, environmental and social field. Protecting forests while producing agricultural products may be a good opportunity for rural areas and rural communities, it may help to protect the biodiversity and natural conditions and create jobs. Agro forestry as the sustainable agro-ecological approach can be successfully introduced to enhance an adaptive agricultural approach that can increase food security and livelihood options as well as addresses the climate change threats (Adhikari et al., 2018).

1.2 Statement of the Problem

Agro forestry is widely recognized as a critical component for promoting livelihood sustainability, especially in rural areas. Scholars like Pundit et al. (2013); Poudel et al. (2019); Khadka et al. (2021) and many other highlighted its potential to enhance rural livelihoods by increasing income, ensuring food security and fostering a harmonious relationship between human and nature to protect biodiversity. These benefits are particularly relevant in Nepal, where agro forestry practices are deeply rooted in the socio-economic and environmental landscape and serve as a critical strategy for addressing issues like soil erosion, land degradation, biodiversity loss and climate change. Forest as an integral part of agro forestry, provide essential organic fertilizers, fodder, and other resources necessary for agricultural growth and environmental sustainability. Despite its potential, several barriers hinder the adoption and success of agro forestry in Nepal. Issues such as unstable political and economic conditions, unclear policy guidelines, insufficient public awareness, and limited resources allocation from public and private sectors are significant challenges (Khadka et al., 2021; Ghimire et al., 2024). In addition to that IC IMOD (2018) argues that there is insufficient scientific evidence to conclusively establish agro forestry's role in ensuring sustainability. This necessitates mainstreaming agro forestry practices while protecting traditional crops and local cropping skills to align with rural livelihood needs.

Giving the contrasting perspective, there is a need to further investigate the role of agro forestry in sustainable livelihood, particularly in rural Nepal. While the unique socio-economic and environmental conditions of rural Nepal, agro forestry's potential to address critical issue, such as climate change adaptation, energy security, and water resource management, these claims require deeper exploration. Rural areas, where opportunities and alternatives are limited, demand targeted research to assess how agro

forestry can effectively contribute to sustainable rural development. Thus, this study aims to explore the role of agro forestry in promoting sustainable livelihood in Bethanchowk Rural Municipality of Kavrepalanchok district by addressing the challenges.

Division Ban Karyalaya (2080 BS) mentioned that there is huge potential of agro forestry on majority household. Due to these reasons, the issue is taken as a prime area of concern for the development researcher and academician to explore the facts behind the adoption of agro forestry in majority of rural area in this country.

1.3. Research Questions

Realizing the face value of agro forestry for strengthening rural livelihood, I have selected agro forestry as a prominent issue for the study. Therefore, this research work were intend to answer the following research questions:

- 1) What are the patterns and trends of agro-forestry practices observed in rural communities and how do these contribute to sustainable livelihood?
- 2) How do the local people in rural communities perceive agro forestry and what are their perspective on its role in rural livelihoods?
- 3) How can agro forestry serve as an effective system for achieving sustainable livelihood particularly through its contributions to income, employment opportunities, food security, and environmental awareness?

1.4 Objectives of the Study

The aim of this research is to investigate the role of agro forestry in promoting sustainable livelihood in rural areas of Kavrepalanchok district. The specific objectives are:

- To identify the patterns and trends of agro forestry practices contributing to rural livelihood in the study area;
- To explore peoples' perception on the role of agro forestry system in rural livelihood;
- To assess the potential of agro forestry in achieving sustainable livelihood with enhanced income, employment, food security and environmental awareness.

1.5 Significance of the Study

Being one of the common agenda of development, agro forestry can play a crucial role to maintain food security and sustainable development in rural areas. Even if it has been practice through the long course of time in Nepal, the modern practices of agro forestry can diversify the sources of income along with food security by departing the conventional practices that further reflects increasing land productivity along with better practice of resource management. The scientific integration of forest and agriculture in everyday practices support climate change mitigation and desirable growth of plants and animal species which will have constructive role on GDP contribution in an economy in rural hill of Nepal. Similarly, combined practices of agriculture and forest contributes multifaceted social, economic and environmental importance. Therefore, this vary topic tries to provide better imperatives to improve rural scene of the country.

1.6 Scope and Delimitations of the Study

In this research work, I have focused on agro forestry system for sustainable livelihood in rural hill of Nepal. Agriculture occupies the greater extent in terms of employment and food supply in the country where forest complements to strengthen agricultural output. So, this research tries to find out the role of agro forestry to make the rural livelihood sustainable. Moreover, I have tried to highlight the major factors that shape the pace of agro forestry for livelihood sustainability and resilience that ensure sustainable development in the country. This research has basically focused on those people who are involved in agro forestry practices. Since, this research is intend to fulfill the academic requirement of Masters of Philosophy (MPhil) in Rural Development under Tribhuvan University, there are some limit of time, resources and generalization of finding. Therefore, I have concentrated only the Bethanchwok Rural Municipality of Kavrepalanchwok district where more than 76 per cent people depends upon agriculture and above 80 per cent land area is covered by forest which is highest in the district while comparing with rest of other Municipalities.

1.7 Operational Definition to Term Used

A groforestry: The term agro forestry represents the farm practices that interplay agriculture with forestry and can have constructive role to one another. Along with the conventional practices of the farmers in rural areas of Nepal, this vary practices implies

the modern scientific management of agriculture and forest sector interplay an invaluable role to jointly address the problem of rural poverty and environmental sustainability.

Agro forestry system: The resource management system that represents the coexistence of agriculture and forestry for the sake of ecosystem services to accomplish food security and sustainable livelihood in an integrated manner.

Agro forestry practices: Agro forestry practices involve the intentional integration of trees, shrubs, crops, and/or livestock on the same land management unit to achieve environmental, economic, and social benefits. These practices are characterized by four key principles such as intentional, intensive, interactive, and integrated. They aim to optimize the interactions between components to enhance productivity and sustainability.

Food security: Food security refers to the condition in which people can maintain their minimal food requirement and does not expect external support. Food security is the fundamental basis for absolute poverty alleviation and initial footsteps for sustainable livelihood mainly in rural areas of Nepal.

Sustainable livelihood: It is defined as the livelihood ability of people and communities to maintain and manage their available means and resources over time that does not deplete the resource base. It basically focuses on long-lasting viability and ensuring the current needs of livelihood without compromising the ability of future generation while meeting their needs. The livelihood sustaining variables are considered as the remarkable change in agro-production, household income, food security, employment and positive change in social variables.

Livelihood resilience: It refers to the capacity of individuals or communities to cope with, adapt to, and recover from stresses and shocks, such as economic downturns, natural disasters, or social disruptions. It involves the ability to withstand adverse conditions, minimize negative impacts, and quickly return to a stable state. Resilient livelihoods often include flexible strategies, social networks, and access to resources that enable effective responses to unexpected challenges.

Rural hill: It refers to the areas located in the hilly and mountainous regions between the Terai plains and the high Himalayas, characterized by lower population densities, a predominance of agricultural activities, limited infrastructure, and diverse ethnic and

cultural communities. These areas face unique challenges due to their geographic isolation and socio-economic conditions.

Agro silviculture (crop with tree/plant): Agro silviculture, or agrisilviculture, is a land management system that integrates the cultivation of trees and crops on the same land. This practice enhances productivity and sustainability through optimized interactions between plant species. It includes methods like alley cropping and home gardens, providing benefits such as improved soil fertility, increased biodiversity, and economic diversification through products like timber and fruits. Particularly valuable in tropical regions, agro silviculture helps mitigate soil erosion and supports the livelihoods of local communities.

Agro silvopastoral (Crop, fruits trees & livestock with pasture): Agro silvopastoral systems integrate the cultivation of crops, fruit trees, and livestock within the same land area, creating a synergistic relationship among these components. This approach enhances biodiversity, improves soil health, and optimizes resource use, leading to increased productivity and sustainability. By combining agricultural practices with forestry and pasture management, agro silvopastoral systems provide multiple benefits, including diversified income sources and improved resilience against environmental challenges. This system is particularly beneficial in dryland regions where it supports both economic and ecological stability.

Silvopastoral (Trees, livestock with pasture): Silvopastoral systems are integrated land management practices that combine trees, livestock, and pasture within the same area. This approach enhances agricultural productivity while promoting environmental sustainability. Trees provide shade and shelter for livestock, improve soil health, and contribute to biodiversity. Silvopastoral systems can vary in design, including spaced or strip planting of trees within pastures. They are particularly beneficial in mitigating climate impacts, reducing soil erosion, and offering additional income streams through timber production, thereby supporting both ecological balance and economic viability.

Home garden (Crops, trees with livestock): Home gardens are defined as integrated farming systems that combine crops, trees, and livestock within the area surrounding a family home. This approach not only maximizes the use of available land but also enhances food security and nutritional diversity for households. Home gardens serve multiple functions, including providing fresh produce, fruits, and animal products while

promoting ecological sustainability through biodiversity. Additionally, they contribute to social and economic stability by offering a source of income and fostering community resilience. By integrating various components, home gardens exemplify sustainable agricultural practices that support both environmental health and family livelihoods.

1.8 Organization of the Study

This research work is organized in six different chapters. First chapter includes background of the topic, problem statement along with research questions, objective of the research, limitation of the study and operational definition. Similarly second chapter is made for literature review which includes conceptual, theoretical, empirical, policy review and the research gap along with conceptual framework. Third chapter is for research methodology which covers the philosophical standpoints of current research, the research design, rational, nature and source of data, size of universe and sampling designs, data collection methods, techniques and tools, reliability and validity of the research, data analysis techniques, ethical consideration, the novelty of the research and the organization of the study. Similarly, fourth chapter is related with data analysis which begins with introduction to the study area, and nature and trends of agro forestry. Similarly, fifth chapter is constituted for the role of agro forestry for rural livelihood along its supporting subtopics. Finally, the sixth chapter composed for summary of findings, conclusion and recommendation of the research. Additionally, the final research report are backed up by proper and organized lists of references along with the necessary appendices and annexes.

CHAPTER - II

LITERATURE REVIEW

The concept of agro forestry has emerged gradually with the human civilization in the sense that it has been a part of human survival through slash and burn cultivation to nature based agriculture system till today (Jha & Sharma, 2009). Most of the rural farmers practice it with due attention to protect their cropland due to flood and land slide which eventually contribute for food security of themselves and fodder for animal they hold. However, modern academics and practitioners has started its scientific thinking, conducted different research mainly after 20th century as a result of rapidly growing challenges of environment and sustainable resource management (Dagar & Tewari, 2017). Therefore, agro forestry has thought to be the best alternatives that can jointly address the problem of income inequality, food security, social well-being and environmental sustainability. For the systematic conceptualization, some scholarly reviews are made to dig out the depth of this concept in following sub-headings.

2.1 Conceptual Review

For centuries, people have practiced growing trees and crops together on the same land, especially in subsistence farming. However, it was only in the last 30 years that these traditional practices have been integrated into modern scientific land-use approaches. Modern agro forestry initially gained traction in tropical regions, where its benefits became evident as serious land-management issues like deforestation, soil degradation, and biodiversity loss arose. During the 1980s and 1990s, agro forestry started being included in national research and development agendas in many developing nations. Longpichai (2012), asserted that agro forestry is a system that requires low external-input and maintain agricultural sustainability from the view point of economic, ecological and social sphere. It has further identified that the economic aspect of agro forestry counted in terms of increased productivity, increased and diversify farm income and secure sustained living standard whereas ecological aspects consist of preserved biodiversity, resource use efficiency and conservation of natural resources. The social strength are related with food security, employment opportunity that represents better social status of people too. That is why this concept has been institutionalizing in recent body of knowledge and as better field of scientific research. Similarly, practicing sustainability is eventually focusing on livelihood which is not just to survive but also maintaining the quality of life of the people for now and in the future without

damaging the prospects to growth and enjoyment (Morse & McNamara, 2013, p 06). Of course, it is a new name of conventional practice of growing useful trees on farmland. Therefore, farmers have been practicing agro forestry form generations and it became more beneficial technique even today as the size of land for cultivation become scarce as well as the fertility of soil is low and prone to erosion, it offers considerable advantages for agricultural sustainability. Furthermore, it has a power to make small farmland more productive and increase income of marginal farmers and hence, contributes for food security in sustainable manner (Raj & Lal, 2014). In this context, Mbow et al. (2014) identified that as a part of knowledge and set of practice, agro forestry has been explore and guide the formal integration of trees into crops along with the livestock through mixed agricultural system at nested scales from a farmer's field to large agricultural landscapes. Similarly, Tiwari et al. (2017) concluded that despite the growing deforestation, the forest resources can play crucial role in improving livelihood of rural people. Moreover, improved agro forestry allows several benefits to farming communities through multiple cropping along with biodiversity conservation and declined over dependence on natural forest. In recent days, the prospect of agro forestry has been emerging as the highly promising option for the sake of making better agricultural productivity and livelihood sustainability of the farmers (Adhikari et al., 2018). Agro forestry is gaining new ground in the quest for climate-smart agriculture practices due to its ability to sequester carbon and mitigate climate change while increasing the socio-economic and environmental sustainability of rural development. Agro forestry can contribute to the achievement of a wide range of Sustainable Development Goals (SDGs) by helping to eradicate hunger, reduce poverty, support gender equity and social inclusion, provide affordable and cleaner energy, protect life on land, reverse land degradation and combat climate change (FAP & IC RAF, 2019). Many evident shows that there is growing attraction of agro forestry through which farmers are more profitable than cultivating agriculture or forestry alone. There are ample opportunities of promoting this system to satisfy the growing demand of food grain along with varieties of forest related products (Mahmud et al., 2014; Adhikari et al., 2018).

Agro forestry itself is the land management system which is said to be suitable ecologically fragile areas. It jointly contributes productive as well as protective attributes of both of the forest and agriculture sectors (Ghimire et al., 2024). That is how the concept of agro forestry become a new blend of agricultural practices with forest vegetation that conventionally comes from time immemorial. Because of the multifaceted attributes of agro

forestry, it provokes systematized and scientific human-ecological assimilation for sustainable livelihood actions.

2.2 Theoretical Review

By the term, agro forestry is an approach or the system of natural resource management in which there is proper integration of trees on farmland and in agriculture landscape that facilitates ecological and economic interaction between forest and farmland (Adhikari et al., 2018). There are different theoretical perspective that are developed to deal with agro forestry practices. Some of the prominent theories of agro forestry that are connected with economic, ecological and social perspectives are overviewed as follows:

Agro ecological theory

This theory posits with the sustainable agricultural practices that favored ecological principles. It focuses on creating sustainable, resilient, and productive agricultural practices through the application of ecological principle in agriculture. This theory is developed and promoted by *Miguel Altieri* and *Stephen R. Gliessman*. The theory assumes agro forestry as a holistic approach comprising ecological, economic and social dimension; biodiversity with enhanced resilience and productivity; resource efficiency through integrated system; sustainability through resilient farming system and integration of local knowledge with scientific farming system. Therefore, integrating ecological principle in agro forestry system, it enhance biodiversity, improved soil health, reduces external inputs and eventually create resilient and productive landscapes (Noordwijk et al. 2016). Agro-ecological principles are becoming widely recognized as effective strategies for promoting sustainable and resilient agricultural systems. By reducing reliance on expensive chemical inputs, agro-ecology supports environmentally friendly practices that not only enhance soil health and biodiversity but also increase productivity at the farm level. This approach encourages the cultivation of a variety of crops and livestock, enabling farms to produce a diverse array of products, which boosts food security, economic stability, and ecological balance (Black, 2017).

Livelihood theory

It is a framework for understanding how people make a living, particularly in rural and resource-dependent communities. Principal propounded of this theory are *Robert Chambers and Gordon Conway along with DFID* developing sustainable livelihood approach. It focuses on the ways in which individuals and households utilize various assets and resources to secure their well-being. Therefore, livelihood theory provides a comprehensive framework to understand and improve the ways in which people in rural areas secure their livelihoods, emphasizing the sustainable management of natural resources and the importance of supportive policies and institutions. A livelihood includes the skills, resources, and actions necessary for sustaining a way of life. It is considered sustainable if it can withstand and adapt to stresses and shocks, preserving or improving its resources, abilities, and activities both in the present and over time for what the natural resource base should not be compromised. It is worthwhile to mention that the sustainable livelihood framework tries to assure following components in development outcomes. They are: people-centered; sustainable; dynamic; responsive and participatory; multilevel and partnership driven (Serrat, 2008).

Economic theory

The economic theory of agro forestry has been shaped by numerous researchers and practitioners who have examined the financial benefits and economic sustainability of integrating trees into agricultural systems. The key contributors are John A. Dixon, David P Gibbon and Peter Huxley. This theory emphasizes the financial benefits and economic sustainability of agro forestry through income diversification, improved forest and farm yields, long-term returns, increased market opportunities along with risk mitigation and cost reduction. Economic theory assumes that agro forestry diversify income sources and reduce the cost of farmers; enhance overall farm productivity maintaining soil health, microclimate regulation and resource efficiency; long term investment over extended period; Greater market opportunities for varieties of products like timber, fruits, nuts and NTFP (non-timber forest product) and, ensured economic sustainability to foster better livelihood, reduced dependency and increased resilience (Arnold, 1987). Agro forestry systems offer diverse outputs, which can help reduce risk, boost income, and are thought to deliver more ecosystem services compared to traditional agriculture. However, our review and case study highlight the limitations of agro forestry and emphasize the need for thorough economic research and analysis to create effective and productive systems, ensuring that both private and public investments in agro forestry are optimized. The efficiency objective of agro

forestry is that the social marginal benefits should outweigh social marginal cost and hence the resource use sustain for long term future (Mercer et al., 2014).

Social theory of agro forestry

Social theory of agro forestry fundamentally emphasize the social dimension of integrating forest into agricultural landscapes. The renowned scholar who contributed this dimension is Elinor Ostrom (Ostrom, 2002). Basic assumption of social theory of agro forestry are community participation; relevance of local cultural practices and knowledge; social equity in resource conservation, and strong social cohesion and community cooperation. The social theory of agro forestry emphasizes the importance of human and cultural dimensions in the successful implementation and sustainability of agro forestry systems along with its biophysical importance (At angana et al., 2014). In a nutshell, it is proposed that agro forestry practices can have effective and sustainable outcomes only when there is inclusive, participatory and culture friendly approach. The most powerful social outcomes of agro forestry are the networks and social connections, such as patronage, neighborhood ties, and kinship bonds, are essential for fostering resilient communities. These relationships build trust, mutual understanding, and support among members, forming the foundation for effective collaboration. Through both formal and informal groups, communities establish shared values, behaviors, and collective norms, reinforcing common rules and sanctions that guide individual and group actions. Mechanisms for inclusive participation in decision-making processes allow community voices to be heard, while strong leadership promotes cohesive representation and guidance. Altogether, these elements contribute to a unified community structure that is better equipped to address challenges and make collective progress (Serrat, 2008).

2.3 Empirical Review

International context

Gangadharappa et al. (2003) conducted an empirical study of 20 randomly selected village of Karnataka and Kerala states of India and concluded that agro forestry is found to be the most desirable strategy for maintaining social, economic and ecological sustainability. Basically, it has viewed that agro forestry formally influence social celebration of festivals, nutritional food habits, adaption of modern occupation, and reduced migration as a result of increased production and income opportunities. That is how social status of the people gradually improved and hence reduces the common social issues like poverty, inequality and

unemployment. Therefore, the finding revealed that the farmers perceived as an appropriate strategy and shown favorable attitude toward agro forestry.

Mercer et al., (2014) have highlighted the economic dimension of agro forestry that analyze the feasibility and efficiency of agro forestry system to deliver the multiple benefits to the people and the economy as a whole. They emphasized the potential benefits such as livelihood risk reduction, income increment, and enhanced ecosystem services which makes it as a promising alternative to conventional agriculture. The authors concluded that agro forestry can be the appropriate system to foster sustainable development through economic, social and environmental benefits. However, it has stressed the need of rigorous economic research and analysis to address the existing limitations that can entails efficient and productive agro forestry system ahead.

Brown et al. (2018) pointed out that agro forestry serves as a valuable link between agriculture and forestry by creating integrated systems that address environmental needs alongside socio-economic goals. This approach strengthens the resilience of farming systems and helps mitigate climate change effects. Research indicates that incorporating trees into agricultural landscapes can prevent environmental degradation, enhance crop productivity, increase carbon storage, and promote cleaner water sources. Additionally, agro forestry supports soil health and biodiversity, contributing to ecosystem stability while offering farmers stable incomes and a range of benefits that positively impact human well-being.

Quandt et al., (2019) conducted a research and tried to explore how agro forestry enhances livelihood resilience for smallholder farmers in Isiolo County of Kenya. The authors sustainable livelihood approach to highlight the role of agro forestry and concluded that the households practicing agro forestry are more resilient to livelihood shocks with a 10 per cent composite resilience score compared to non-agro forestry households. Therefore, agro forestry is vital tool for building livelihood resilience in uncertain environments offering financial, environmental, and social benefits to the vulnerable communities globally.

Agro forestry and sustainable landscape management are essential for advancing the UN Sustainable Development Goals within global production mechanism, yet they have typically been studied separately. The authors clearly specify 6 key actions to leverage agro forestry for sustainable landscape management, which include:

- a) Developing an “agro forestry sustainability science”;
- b) Understanding local land-use histories and traditions;
- c) Expanding agro forestry to achieve broader landscape benefits;
- d) Highlighting its economic, environmental, social, and cultural values;

- e) Encouraging inclusive landscape governance; and
- f) Supporting innovation in analyzing and designing agro forestry systems (Plieninger et al. 2020).

Sollen-Norrin et al., (2020) have identified soil degradation as a major global concern because of unsustainable agricultural practices mostly in Europe. So, the authors viewed that agro forestry system as a promising solution that systematically improve soil health, agronomic productivity, carbon sequestration, water retention as well as protecting biodiversity which formally reduce soil erosion and risks of forest fire too. Even if there are some sorts of challenges such as; high implementation cost, lack of financial incentives, marketing limitations along with poor education and awareness among farmers, the agro forestry system are taken as one of the powerful tool to ensure livelihood through protected soil health. However, the enhanced agro forestry adoption would be possible if there are better policies that ensure financial support mechanism, improved consumer awareness through better marketing mechanism and necessary education and training to the landowners.

Reliable and sustainable access to essential resources, including income, food, clean water, healthcare, and education, is crucial for well-being. Preserving stable livelihoods is a critical challenge for policymakers today. In light of this, land-use strategies that ensure livelihood security while addressing climate concerns are urgently needed. Agro forestry can significantly contribute to these goals by promoting diversity and sustainability within land management. It has the potential to enhance food security, reduce poverty, and play a vital role in environmental conservation, such as protecting soil and sequestering carbon. Traditional practices like agro forestry offer versatile livelihood solutions by providing food, fodder, and fuel, all while mitigating climate change impacts (Bansal et al., 2021).

Duffy et al., (2021) have conducted a study regarding the agro forestry contribution to food security and climate resilience of Indonesia by the help if systematic review of 22 peer-reviewed articles revealed that agro forestry holds significant potential to enhance the food security of smallholder farmers. The authors comparatively analyzed the contribution of traditional agro forestry (home garden) and commercial agroforestry where traditional offers more dietary benefits comparing the more economic benefits from modern one. However, the findings highlighted that there is multi-faceted benefits of agroforestry of both type especially for food security and environmental resilience through more crop yield, off-farm work options, reduced fuel wood consumption, and greater access to medicinal plants.

Raihan (2024) in a review article highlighted on the role of agroforestry in enhancing human well-being and addressing climate change adaptation and mitigation in South Asian

countries. It has focused the potential of agroforestry systems to achieve international climate goals, particularly under the commitments of the Nationally Determined Contributions (NDCs) to the UNFCCC. The paper also examines enabling factors and barriers to the mainstream adoption of agroforestry, emphasizing the importance of moving from planning to implementation for achieving national climate ambitions.

National context

Neupane et al., (2002) identified that deforestation and unsustainable land use have led to soil erosion, declining soil fertility, and reduced agricultural productivity in Nepal's hill farming systems, raising concerns about long-term sustainability. Agroforestry has emerged as a potential solution, but its widespread adoption remains challenging due to diverse ecological and socio-economic conditions. A study of 223 households in Dhading district found that male NGO membership, female education, livestock population, and positive farmer perceptions significantly increased agroforestry adoption, while the number of young children, male-headed households, and certain demographic factors hindered adoption. The findings highlight the importance of community engagement, gender-inclusive education, and livestock integration in promoting agroforestry. To ensure wider adoption, policies should focus on strengthening local institutions, enhancing female participation in decision-making, and providing targeted support for diverse farming communities.

Regmi (2003) conducted a survey research of Majhitar village of Dhading district for examining the impact of agroforestry to improve economic condition of marginal farmers reveals that shifting livelihood priorities through agroforestry have motivated households to increase tree planting, boosting farm income, enhancing tree diversity, and saving time for women collecting fodder and fuel wood. While agroforestry shows potential for supporting rural livelihoods, reducing forest pressure, and conserving biodiversity, conversely, it has also widened disparities between households with large versus small landholdings. However, the existing government policies focus on state-owned forestlands, and hence overlooked support for protecting and marketing on-farm agroforestry products.

Dhakal et al., (2012) have conducted a study regarding the evolution of agroforestry based farming system in Dhanusha district of Nepal following the conversion of forests into agricultural land in the 1950s. The research used focused group discussions with farmers and experts, by categorizing the farming system into simple agriculture, less integrated, semi-integrated and highly integrated agroforestry depending on the farm size, cropping intensity, tree intensity and diversity, input used, and labour force applied. They have identified key drivers of land use change including infrastructure, advancement in technology, institutional

supports, and extension programs. The findings emphasized that the growing integration of agriculture, livestock and forestry showcasing the transition from basic farming to more sustainable and diversified agroforestry system over time.

Similarly, Pandit et al. (2014) have conducted a field based research locating Mahadevstan and Mithinkot village of Kavrepalanchok district applying mixed method approach to investigate the impact of agroforestry on rural livelihood and identified agroforestry as a system which support the livelihoods of so many rural farmers of mainly hill regions of Nepal even it has given less attention to its conservation and socio-economic values. The result revealed that the considerable change has been found in agroforestry system over time. As a result the remarkable change in the number of tree species including fruits, grasses, fodder and medicinal plants subsequently facilitates the animal products and income opportunities and hence increased livelihood outcomes.

Tiwari et al., (2017) focused agroforestry as a sustainable natural resource management system that integrates trees, crops, and livestock to maximize land productivity while ensuring ecological and economic benefits. In Nepal, agroforestry plays a crucial role in carbon sequestration and climate change adaptation, particularly in the mid-hills, where it provides essential resources like fodder, fuelwood, and food while reducing dependency on forests. This research indicates that agroforestry systems store significant amounts of carbon, with estimates ranging from 12 to 228 MgC/ha, and Nepal's mid-hill agroforestry contributing around 48.60 tons of carbon per hectare. Beyond carbon storage, agroforestry serves as a climate mitigation and adaptation strategy, helping farmers build resilience against environmental changes. By promoting biodiversity, soil conservation, and sustainable livelihoods, agroforestry is a key approach to balancing agricultural productivity and environmental sustainability in Nepal.

Pandit et al., (2019) have conducted a market-oriented agroforestry action research program in Kavre and Lamjung districts during 2013-2016. The research found that market driven agroforestry significantly improved household income up to 48 per cent that helped the poorest households for food security up to six additional months. The system said to be able to lift 63 per cent household out of poverty and reduced food shortages. The study emphasizes the need for collective marketing strategies to eliminate middlemen and maximize returns. Key success factors include farmer motivation, a favorable environment, and social incentives to encourage the cultivation of high-value agroforestry products.

Khadka et al., (2021) in their study emphasized the potential of agroforestry as a sustainable land-use system that maximizes profit and supports local livelihoods, particularly

in fragile regions like the Chure in Nepal. The study in Bakaiya rural municipality of Makawanpur District, highlighted the dominance of agri-silviculture and agri-silvi-pasture systems, which provide essential resources such as fuel wood, fodder, and leaf litter. Although agroforestry fulfills significant subsistence needs and complements community forestry, its development and promotion remain inadequate. The major challenges such as lack of promotion, technical support and absence of policy recognition are identified as basic hindrance for widespread adoption and development. Therefore, it has recommended that collaboration between local communities and stakeholders is essential to enhance the promotion and better implementation of agroforestry in Nepal.

Poudel et al., (2021) in their study concluded that improved agroforestry practices in the midhills of Nepal are significantly more beneficial than traditional practices, particularly in terms of income generation and meeting forest product demands. Farmers adopting improved practices earn over twice as much annually and fulfill 84 per cent of their forest product needs compared to only 50 per cent for traditional practitioners. Specifically, improved systems excel in producing fodder, fuel wood, and timber, enabling self-sufficiency in forest products. Therefore, this study advocates for transitioning from traditional to improved practices of agroforestry can maximize its contributions at the local level.

Ulak et al., (2021) studied the status of agroforestry system and practices in the terai and hill regions of Nepal and found multiple system and varieties of practices. This study revealed growing interest in commercial agroforestry and gradual shift from traditional one even it is prevalent in many part of the country. Further, this study identified many challenges such as shortage of labour, land fragmentation, technical knowledge gaps, and market volatility that should be addressed to harness the maximum benefit from agroforestry. However, agroforestry continues to play a vital role in sustaining livelihoods and promoting environmental conservation in Nepal.

Dhakal et al., (2022) have highlighted agroforestry as a sustainable alternative to conventional crop-focused farming in Nepal. Agroforestry can offer the solutions to environmental degradation, food insecurity, and socioeconomic challenges that prevails in most part of the country. It is further stated that even traditional agroforestry practice prevail but overshadowed by modern system as a result of growing focus on climate change and sustainable development focusing tree-based farming system for multiple benefits. Overall, agroforestry in Nepal offers a resilient and sustainable farming model, addressing economic, social, and environmental challenges considering global goals of climate and development.

Therefore, agroforestry could be the good prospects for sustainable future by overcoming the institutional, financial and awareness barriers in the country.

Poudel et al., (2022) conducted the study in mid-hills of Nepal, reveals that although most farmers experience climatic challenges, only about 59% recognize them as climate change-induced challenge, and just 55% have applied adaptation measures. Farmers primarily focus on livelihood improvement, income generation, and food security, considering agroforestry as a secondary adaptation strategy rather than a direct response to climate change. Factors such as age, education, gender, habit of growing commercial species, and income from tree products significantly influence farmers' decisions regarding adaptation and improved agroforestry practices. The study emphasizes the need for education programs—including training, exposure, and outreach initiatives—to enhance awareness and adoption of improved agroforestry techniques. These findings provide valuable insights for local, national, and international agencies to develop effective climate adaptation and agroforestry promotion strategies.

Poudel and Shrestha (2022) in their article highlighted the rich tradition and diversity of agroforestry practices in SAARC countries like; in India and Nepal that showcase the system of integrating livelihood with sustainable land management practices. The authors focused on the need of exploring, improving and advocating agroforestry system through proper policy formation, better research and development, extension and training services along with addressing the challenges related to implementation and scaling of the system. Therefore, it has pointed out that agroforestry is a vital tool for improving livelihoods and environmental sustainability in SAARC countries.

Ghimire et al. (2024) in their study have concluded that agroforestry systems in Nepal have become essential for advancing sustainable agriculture, boosting economic opportunities, and supporting environmental conservation. This integrated approach to land management combines forestry, agriculture, and livestock, delivering numerous benefits to rural communities and the environment. Nepal's varied agroforestry systems, such as agrisilviculture, agrosilvopastoral, and home gardens-have provided farmers with additional income and addressed key challenges like food insecurity and land degradation. By incorporating trees with crops, agroforestry improves soil health and increases carbon storage, aiding in climate change mitigation efforts. The authors further highlighted that despite its benefits, agroforestry in Nepal faces challenges, such as limited technical knowledge among farmers, weak governance structures, and the need for targeted research to adapt systems to specific regions. Integrating agroforestry into national development plans is

essential for tackling issues like land scarcity, climate change, and food security in low-income countries like Nepal, as well as for progressing toward the Sustainable Development Goals.

2.4 Policy Review

There are many different national and international policy measures to promote and strengthen agroforestry in different countries. India, the immediate neighbor of Nepal, has set different agroforestry related policies and adopted varieties of technology to promote its importance. Similarly, Nepal also has made many specific efforts and policy measures to cope with the growing importance of agroforestry in the country. Some of the policy measures are as follows:

The Forest Sector Master Plan of Nepal (1989–2010) is considered to be one of the fundamental policy document that recognized agroforestry as a key strategy for sustainable land management, rural development, and environmental conservation. The plan aimed to integrate trees, crops, and livestock to improve livelihoods, reduce deforestation, and enhance biodiversity. Of course, this plan laid the foundation for later policies, including the Forestry Sector Policy (2000), National Agroforestry Policy (2019), and so on which further strengthened agroforestry integration in forestry and agricultural sectors in the country (Ministry of Forest and Soil Conservation, 1988).

The Forestry Sector Policy (2000) of Nepal emphasizes sustainable forest management, biodiversity conservation, and community participation. Agroforestry plays a significant role in achieving these objectives by integrating forests, crops, and livestock to enhance livelihoods, ecosystem services, and climate resilience. The policy recognizes agroforestry as a critical strategy for sustainable land management, poverty reduction, and biodiversity conservation. The policy promotes community participation, private sector involvement, and policy reforms to integrate agroforestry into the broader forestry and agricultural sectors. By enhancing livelihoods, conserving ecosystems, and strengthening climate resilience, agroforestry is positioned as a key component of Nepal's forestry development strategy.

The first national consultation workshop on "Present status and future prospects of agroforestry in Nepal" and decided to develop a National Agroforestry Policy for Nepal that was addressed by releasing "Kathmandu Declaration on Agroforestry" on 28th March, 2015 as a first institutional effort . The workshop was jointly organized by Ministry of

Agricultural Development and Ministry of Forest and Soil Conservation of the government of Nepal and World Agroforestry Centre (ICRAF) and the Asia Network for Sustainable Agriculture and Bio-resources (ANSAB). It has realized that strengthening agroforestry research and development and its application to institutionalize the concept and its good practices and scaling up of promising agroforestry technologies to enhance production and productivity along with realization of its contribution in socio-economic development, energy and food security and environmental sustainability (Kathmandu Declaration on Agroforestry, 2015).

As a regional effort to strengthen the importance of agroforestry, SAARC Resolution on Agroforestry 2016 has been released on 3rd June, 2016 by making two phase programme. First phase consists of six years taken to establish the mechanism and delivery system to secure the benefits of agroforestry to the targeted communities and the second phase with another six years for out scaling benefits in wider scale. Therefore, second phase requires the efforts in first phase which encompasses four important pillars of agroforestry. They are:

1. Creating awareness and developing guidelines, codes of conduct, and/or policy, and databases of available information on agroforestry and agro foresters,
2. Building capacity targeting various players and stakeholders both at institutional and individual levels,
3. Identifying and re-designing (where necessary) of location-specific agroforestry systems,
4. Demonstration/dissemination of the identified successful agroforestry systems (ASSRE Resolution on Agroforestry, 2016)

Considering the vitality of agroforestry in relation to multiple integration of ecology and economy, the efforts to institutionalize agroforestry has been initiated since 2014. After the numbers of regional, national as well as international consultation and workshop with the involvement of different governmental as well as non-governmental organizations from within and outside the country along with civil societies, academics and researchers, farmers associations, local representatives and many others have taken part to formulate the national policy of agroforestry throughout the period until 2019. As a result of numerous efforts by all the stakeholders, National Agroforestry Policy of Nepal has approved by the Cabinet of Nepal in 23rd of June, 2019 as a formal policy document to formalize agroforestry in Nepal (Chronology of National Agroforestry Policy Development in Nepal 2014-2019AD). Now there is a separate agroforestry policy in Nepal put forwarded by Ministry of Agriculture and Livestock Development having a long-term vision “to contribute in the national prosperity through the development, expansion and commercialization of the agroforestry system”. The

policy has taken five different objectives comprising of increase production and productivity of land for agriculture, livestock and forest; conserving environment and biodiversity; creating opportunities for income, employment and food security through agroforestry; economic growth and investment opportunities in agroforestry; and conducting research and capacity enhancement in the area of agroforestry (MoALD, 2019).

The Policy Brief on Agroforestry Development in Nepal (2019) highlights the importance of agroforestry as a sustainable land-use system that integrates trees, crops, and livestock to enhance livelihoods, environmental sustainability, and economic growth. The document emphasizes that while agroforestry has long been practiced in Nepal, it has not been sufficiently recognized in policy frameworks or land-use planning. The document underscores agroforestry's critical role in sustainable development of the country, linking food security, climate resilience, and rural economic growth. However, policy gaps, institutional weaknesses, and market barriers hinder its full potential. Strengthening policy implementation, capacity building, and financial incentives is essential for expanding agroforestry practices and ensuring long-term sustainability (Forest Research and Training Centre, 2020).

Nepal has made significant progress in reducing food insecurity and poverty, but challenges persist in ensuring equitable access to food, improving livelihoods, and addressing nutritional disparities among marginalized groups. Additionally, natural hazards and climate change continue to threaten rural communities. In response, the World Food Programme (WFP), in partnership with the Nepalese government, has developed a strategic plan aligned with national and global development frameworks to strengthen food security, nutrition, and resilience. The plan focuses on four key outcomes: addressing food and nutrition needs, improving education and dietary access, supporting smallholder farmers through climate-resilient food systems, and enhancing government and humanitarian capacities for crisis response. By supporting Sustainable Development Goals (SDGs) goal 2 relating to Zero Hunger, goal 4 consisting Quality Education, goal 13 consisting Climate Action, and goal 17 relating to Global Partnerships, the strategy aims to create sustainable, inclusive, and resilient food systems in Nepal, ensuring long-term food security and economic stability (WFP, 2023).

Similarly, the sixteenth five year plan of Nepal has emphasizes sustainable development, climate resilience, and environmental conservation by which the country can achieve sustained growth during the plan period. Even if sixteenth plan does not explicitly introduces the detail on agroforestry initiatives, it underscores the significance of integrating

agro-ecological practices into national development strategies because, agroecology in the similar form of agroforestry, has truly recognized its role for promoting sustainable agriculture, biodiversity conservation, and improvement of rural livelihood in the country. Incorporating agroecological perspectives in the broader objectives of environmental sustainability and climate change mitigation, Nepal aims to achieve sustainable agriculture development and resilient ecosystem reflecting the true value of agroforestry into the planning framework (National Planning Commission, 2024).

2.5 Methodological Review

From the blind of the numerous research undertaken in different part of the world in different circumstances, mixed method is said to be the new paradigm that provokes the multiplication of the quantitative and qualitative approach so that the result supposed to be more flexible, integrative, holistic and rigorous relevant and precise while addressing a range of complex research question under study (Onwuegbuzie, et al., 2007). As mentioned by Leech & Onwuegbuzie (2009), there are varieties of mixed method design applied by various researchers depending upon the issue and related circumstances, all the types are based on the three dimensional typology. These three dimensions are:

- a) Level of mixing dimension (fully versus partially)
- b) Time orientation dimension (concurrent versus sequential) and;
- c) Emphasis of approaches dimension (equal status versus dominant status).

Depending upon above mentioned three dimensions, there are 8 types of mixed method design representing two in each group can be seen as follows:

-) Fully mixed concurrent equal status versus dominant status research design;
-) Fully mixed sequential equal status versus dominant status research design;
-) Partially mixed concurrent equal status versus dominant status research design;
-) Partially mixed sequential equal status versus dominant status research design;

(Leech & Onwuegbuzie, 2009, pp. 268-272).

There are varieties of research methods applied to undertake agroforestry research by different scholars and organizations. Among them majority research are found to be based on the biological science whereas some of the researches focused on social approach. Mbow et al. (2014) undertaken a review based study and have identified that agroforestry to be adopted for the agricultural sustainability, food security and better pathway for achieving many sustainable development goals. Fadl and Ahmed (2015) adopted field survey for data collection and descriptive statistics have been used to analyze the result. Pokhrel et al. (2015) have also applied the random sampling of two different village from two district of Nepal and taken home gardens as a study point in their research. Some specific statistical techniques for data analysis have been applied and interpreted the result.

Ghimire & Bolakhe (2020) have taken the socio-economic survey comprising field observation, Questionnaire survey, key informant interview and group discussion have been made to find out the farm tree diversity and carbon stock to contribute on rural livelihood of

local people. Ulak et al. (2021) have applied qualitative approach of data collection by applying snowball sampling technique and conducted desk review, semi-structured interviews, Focused Group Discussion, phone interview to explore the existing agroforestry practices challenges and possibilities in the Terai and Hills of Nepal. The data were analyzed by using Microsoft Excel software and interpreted the result. Elbakidze et al. (2021) have adopted the case studies of some four countries of North-Eastern Europe and used structured interview of 1636 respondents all together to collect the data and analyzed the perceived benefit from agroforestry in improving the quality of life of the people under study. Pandit et al. (2014) in a case study of Kavrepalanchok district concluded that agroforestry significantly helped to reduce the shortage of forest product as a result of reversal of degraded forests that had happened in the past. That is why agroforestry eventually contributes to increased livelihood benefits rural people. In this way, there is no uniformity in the research methods and found to be contextualized according to the nature and strength of the objective set by the specific research work. Therefore, I did not found the enough agroforestry research that are undertaken by applying mixed method approach in case of developing countries like Nepal and my research is supposed to be more empirical one in this field.

2.6 Summary of the Literature Review

On the basis of above mentioned reviews, agroforestry seems a prominent issue in developing countries like Nepal where majority of the people are depending upon nature based agriculture system and there is plenty of prospect of forest conservation for human sustainability. Overall, different conceptual literature specify agroforestry as a combined practices of resource management for better livelihood to be materialized through the collaborative handling of agriculture and forestry together. The evolution of agroforestry integrates traditional practices with scientific land-use methods, especially in tropical areas facing deforestation, soil degradation, and biodiversity loss. Modern agroforestry systems support sustainable agriculture by increasing productivity, diversifying income, and conserving resources, thus offering economic, ecological, and social benefits to rural communities. Various theories underpin these benefits: agro-ecological theory emphasizes ecological principles, livelihood theory examines resource use for community well-being, economic theory highlights financial sustainability, and social theory focuses on the importance of community cohesion.

Empirical studies show agroforestry's role in supporting rural livelihoods, preserving biodiversity, and mitigating climate impacts. Despite challenges such as governance and technical expertise gaps, agroforestry's integration into Nepal's policy framework is seen as crucial for achieving Sustainable Development Goals. Methods in agroforestry research vary widely, from field surveys and socio-economic assessments to case studies, though mixed-method approaches are less common. Developing a vigorous empirical foundation in agroforestry research can further optimize its benefits for sustainable livelihoods in resource-dependent communities.

2.7 Research Gap

Since, there are many different research and scholarly publications made in various socio-economic condition within and outside the country along with the theoretical and policy setups, some gaps on agroforestry that would have been open up for achieving Sustainable Development Goals put forwarded globally and the national policy backup to accomplish these global goals. Despite having numerous scientific and scholarly undertaking, still there is absence of clear cut study in the country that covers hill ecological region where intensive agroforestry system have been practicing from due course of time seems to be lacking. More specifically, the sustainability and resilience of agroforestry applying mixed method approach in local context has not been focused yet. Additionally, there are some methodological and practical gaps in the field of agroforestry that should be fulfilled by the researcher ahead. Therefore, this research has intend to fulfill the existing research gap in the field of agroforestry.

2.8 Theoretical and Conceptual Framework

Theoretical framework

This research is fundamentally based on the well-established theoretical framework developed by DFID (1999) named as *Sustainable Livelihoods Framework* (SLF) which identifies a range of factors that influence livelihood strategies and outcomes, highlighting the interconnections among them. At its core, it is a pentagon representing five types of livelihood assets such as; natural, social, physical, financial, and human-which households and communities can draw upon to achieve desired livelihood outcomes and reduce vulnerability to shocks, trends, and seasonal changes. Access to these capitals is shaped by transforming structures (such as government levels, private sector, and civil society) and

processes (like laws, policies, culture, institutions, and power dynamics), which also contribute to livelihood vulnerability. The framework's Sustainable Livelihoods Guidance Sheets define six key concepts, including people-centeredness, a holistic and dynamic approach, strength-based building, linking micro and macro levels, and sustainability. Over time, critiques led to the addition of new principles, such as being empowering, responsive and participatory, multi-level, conducted in partnership, disaggregated by factors like gender and socio-economic status, and flexible for long-term application (Bennett, 2010; Moors & McNamaraNatarajan et al., 2022).

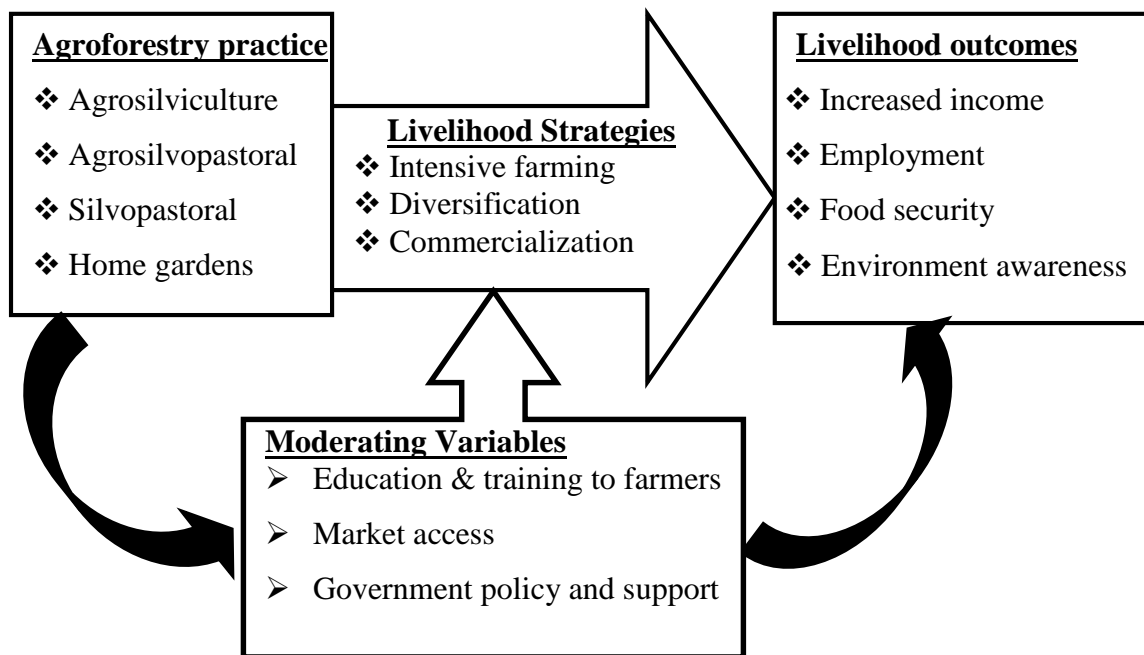
In a nutshell, The Livelihoods framework includes the skills, assets (both tangible and social), and strategies that individuals and communities use to sustain themselves. Sustainability means that these people can face and overcome stress or crises while preserving or enhancing their skills and assets over time without depleting natural resources. Therefore, the approach follow the system approach to understand the livelihood by conceptualizing in following ways:

- The resources or assets essential for people's needs
- The ways through which people sustain their livelihoods
- The specific context for which support is intended
- Any elements that could enhance resilience to stress and crisis (UNDP, 2017)

Conceptual framework

The current research work has focused on the strength and the importance of agroforestry system that facilitates different kinds of services and livelihood assets through which the livelihood become sustainable poses by agroforestry can be explored. Fundamentally, this framework is based on the SLF framework of DFID. To explore the contribution of agroforestry, this research is based on following conceptual framework:

Figure 2.1



Conceptual framework for Agroforestry (AF) analysis

Note. Developed by researcher

Defining concepts

Agroforestry practices: It refers to practices that involve the intentional integration of trees and shrubs into agricultural landscapes, providing various ecological, economic, and social benefits. In the Nepalese context, several types of agroforestry practices are prevalent, each suited to different ecological zones and farming systems. Among the various types, this research intend to focus on the following common agroforestry practice in the hill region:

Livelihood strategies: The range of activities and choices that individuals or households undertake to achieve their livelihood goals. These strategies usually involve a mix of agricultural, non-agricultural, and wage-labor activities that are performed with the available resources for the betterment of their survival.

Intensive farming: It refers to a farming practice aimed at maximizing yields per unit of land through the use of highly productive inputs like fertilizers, pesticides, labor, and advanced technologies. It focuses on efficient land use and often involves multiple cropping and intensification.

Diversification: The process of broadening income sources or livelihood activities to reduce risks and increase resilience. It may involve engaging in multiple crops, off-farm employment, entrepreneurship and occupational variation to improve economic stability.

Commercialization: The transformation of subsistence agriculture or small-scale production into market-oriented activities, where goods and services are produced primarily for sale rather than just for personal consumption. This shift often involves adopting modern technologies, improved infrastructure, and market linkages.

Increased income: It is achieved through the diversified income source and increased productivity in the farmland as a result of agroforestry.

Food security: Food security is the prime concern of Nepalese farmers which is achieved through improved crop yield and year round food production that contribute the dietary stability.

Social wellbeing: It is representative variables that demonstrate through the learned practices of skill, knowledge and resources sharing for common benefits in the society.

Employment Opportunities: It refers to the state of opportunities accessed to the people in the study areas who are adapting agroforestry as a fundamental source of livelihood and it is assumed to be raised by the help of innovative practice of agroforestry in the study area where this research work is concentrated.

Environmental awareness: It refers to the ability to understand and to delve with the basic environmental issues or challenges such as natural disasters, climate change, and tries to cope with such inconsistencies and disturbances by developing tolerance and recover from them possibly through resource conservation and sustainable practice with community involvement.

Moderating variables: Moderating variables are the factor that can either enhance or hinder the effectiveness of agroforestry practices in improving livelihood sustainability in the study area. For instance, education and training to the farmers facilitates better productivity and innovative courage, while access to markets ensures that farmers can sell their agroforestry products at profitable prices whereas government policy and support are the tools by which the rural farmers can have better access with the administrative support and inputs in an affordable ways. Eventually, each of these factors formally contribute for sustained income and productivity, food security along with increased social well-being so that people can cope with any kinds of economic, social and environmental inconsistencies.

CHAPTER - III

RESEARCH METHODOLOGY

3.1 Philosophical Standpoint

Every research demonstrate its scientific rigor by grounding its findings and discussion in philosophical standpoints. This study addresses common social issue influenced public perceptions, and thus avoids reliance on absolute realities or singular approaches. Being based on the pluralistic approach, it follows the pragmatic worldview as a philosophical standpoint that integrates various approaches, methods and technique of data collection and analysis. In fact, it follows many different ways of investigation and interpreting the world and conducting research to manifest reality. This research is based on the discipline-based theoretical lens because the issue picked up from social outcome and the variables identified has tried to interrelate them and expected result are explained for the sake of betterment of society and country as a whole (Creswell & Creswell, 2023). This study does not align with the post positivist paradigm in the sense that it does not focus solely on empirical observation and predetermined theoretical setup for its verification. It also diverges from the constructivist paradigm as it does not aim to generate theory based on the participant's multiple meaning or social constructs. Similarly it avoids the transformative paradigm, which is politically driven and focused on structural power dynamics. Indeed, it is thought that the combination of different approaches would be the good way to accomplish broader understanding of the phenomena being investigated which is real problem oriented in nature to identify the consequences of the action.

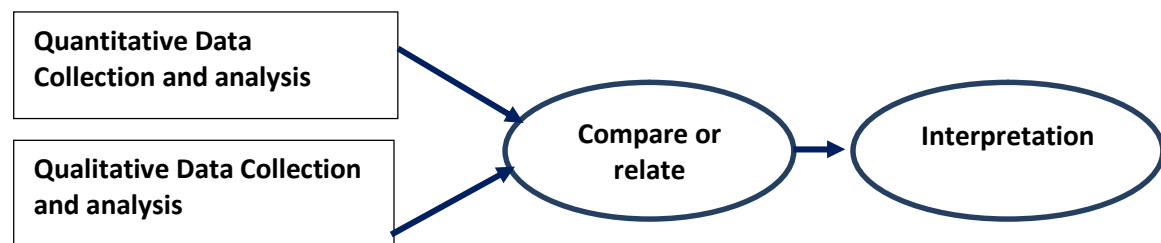
3.2 Research Design

This research employs a *convergent mixed method design* where the results are interpreted by merging the data obtained from qualitative as well as quantitative sources for analysis (Creswell & Creswell, 2018). Specifically, it follows a *fully mixed concurrent dominant status design* where quantitative and qualitative phases are conducted simultaneously with greater emphasis on quantitative phase during data collection and analysis (Leech & Onwuegbuzie, 2009). The mixed method approach is appropriate to minimize the shortfalls of any single approach of research by validating the result obtained from one-another. This research is based on descriptive framework and is intended to focus on inductive reasoning. As a descriptive, this research tried to identify

the existing situation of the agroforestry system in the study area. Furthermore, this study can help to assure sustainable management of available natural resources to increase food production by finding out the answer of research questions. Furthermore, this research is trying to explain the existing facts to identify the significance of agroforestry for livelihood sustainability and to access the best potential ways to improve agroforestry in the society which has not been properly studied before. The research design framework is shown in the figure 3.1.

Figure 3.1

The convergent parallel research design



Note. Creswell & Creswell (2023, p. 236)

3.3 Rational of the Study Area Selection

The research work will try to highlight the strength of agroforestry in sustainable livelihood system in rural areas of Nepal. There is an urgent need to identify the better way to declare the alternative path of development that would be sustainable in nature and can have the good prospect to Nepal. This research has tried to represent the existing agroforestry practices of Bethanchwok which would be representative to entire mid hill region of Nepal. Since, the current research lies in the Kavrepalanchok district of Bagmati province, it would be exemplary research to understand the multiple importance of resource management practices to the rural people where they are lacking other livelihood options even if they are closer to federal capital. Furthermore, Bethanchwok rural municipality has selected considering the highest population dependence in agriculture and maximum coverage of land area by forest. That is why, this research reflects the true strength of agriculture as well as forestry practices jointly contributing for rural livelihood sustainability and would leave reflective outcome in the concerned research field.

3.4 Nature and Sources of Data

The data are qualitative as well as quantitative in nature and are collected from primary as well as secondary sources. Qualitative data are obtained from key informant survey from the field level whereas quantitative data are collected from questionnaire survey and some available secondary sources; such as: Municipal profile, data from different governmental websites of concerned authorities, community forest users group and other published as well as authentic unpublished sources.

3.5 Universe, Sampling Procedure and Sample Size

The Bethanchwok rural municipality of Kavrepalanchok district which lies in the mid-hill region of Nepal is the study universe. This research is based on mixed methods approach and hence both the quantitative as well as qualitative data are collected from the field level. The qualitative data are collected from key informant interview (KII) which is applied to the purposively selected 14 key informants representing two renowned agriculture related persons from each six wards and 2 more persons are from agriculture related institution by the help of unstructured questions. Whereas, quantitative data are collected from household survey by administering structured questionnaire to the selected units at household level. CBS (2022) shows that there are a total of 3483 household who belong to agricultural household as per the record maintained in National agricultural census 2021/2022 are the study population are the study population. However, as per the information available in municipal profile of Bethanchowk, 3162 household, who use their land for agriculture are taken as study population. In general, the entire study area are administratively divided into six different wards which are considered as different strata and data collected representing equal proportion irrespective of total agricultural household from each strata. Therefore, a total of 356 sample are selected for household survey applying stratified random sampling following standard formula of sample size determination by Taro Yamane (1967) for quantitative survey.

The formula is given by: $n = \frac{N}{1+N \times e^2} \dots (1)$;

where, n = Sample size; "N" = total population size and;

"e" stands for probable error term that normally holds the value 0.05 in this case considering 95 per cent confidence level.

Sampling distribution of the different ward are shown in the following table:

Table 3.1

Ward-wise agricultural household and respective sample taken

Household detail	Ward numbers						Total
	1	2	3	4	5	6	
Household by Land use for agriculture	265	492	548	793	599	465	3162
Ward wise percent of agricultural land use	8.38	15.56	17.33	25.08	18.94	14.71	100
Number of sample as per total household ratio	30	55	62	89	68	52	356

Source: Bethanchowk Gaunpalika, 2076BS

3.6 Data Collection Method, Techniques and Tools

The data for this research are collected from primary as well as secondary sources which are quantitative as well as qualitative in nature. Primary data are collected from household survey for quantitative information by using closed-ended questionnaire and qualitative data are collected from Key informant interview that are made by using open-ended questions with 12 persons representing 2 persons from each ward and 3 persons from other renowned sector working in the field of agroforestry. Additionally, two focused group discussion are made focusing on the persons from related field. Secondary data are collected from different published, unpublished as well as digital sources consisting different governmental, and other institutional sectors.

3.7 Reliability and Validity

Reliability is the fundamental concern of this research, ensuring that the findings are consistent and replicable. Therefore, this research would be supposed to be reliable in a ground of authentic sources and tools of data collection along with triangulation of qualitative as well as quantitative information collected from the field level. Additionally, pilot test has been made before conducting main study so that any significant issue could be fixed and well prepared along with the use of standard and reliable tools of data. A

Cronbach's Alpha have been applied for selected 11 questions from the questionnaire and the value of $\alpha = 0.844$ indicates a strongly reliable measurement scale, making it appropriate for research on agroforestry, livelihood sustainability, climate adaptation, or similar topics in Nepal.

In terms of validity, internal validity is established by perfect randomization of the sample and external validity are made through better representation of diverse areas along with two expert consultation from the central department of rural development for measuring tools and technique. Furthermore, the findings are cross verified by triangulating the research outcome from qualitative and quantitative data. Finally, participant validation is employed to confirm that the research accurately reflects their perspectives, while maintaining ethical consideration throughout the process. This comprehensive approach to reliability and validity contributes to a trustworthy research framework that enhances the overall integrity of the study.

3.8 Methods of Data Analysis and Interpretation

All the collected data are processed and arranged in a systematic manner and mobilized for meeting the objectives of the research. Some necessary descriptive statistical tools and techniques like tables, figures and charts are used while analyzing the data. Further some statistical tools like percentage, average, and correlation are applied as necessary to process the data for which some analytical software and tools like; SPSS for quantitative data and MAXQDA for thematic analysis of qualitative information are applied. The processed data are analyzed and presented based on the research objectives. Both the qualitative and quantitative data are mixed purposively so that the final report can reflect the desirable findings of the study.

3.9 Ethical Consideration

This research work does follow the fundamental ethics of social science research so that any randomization and arbitrary explanation in the entire research work are avoided. All the participants were fully informed about the purpose, method and potential use of research so that their participation does not infer any risks. This research maintains full confidentiality of information provided by the participants and also respects their response. Similarly, respondents and other participants have been taken part voluntarily and free from any coercion. Prior to engaging in the research process, participants'

consent was obtained to minimize any potential burden on them. The study adheres to the ethical guidelines set by the professional association in this field. Personal conflicts of interest and biases have been strictly avoided, and no information harmful to participants was collected during the study. Equal treatment was ensured for all participants when confirming their participation. Additionally, the researcher has maintained awareness of properly crediting original authors when citing their work and has remained vigilant in avoiding plagiarism of existing literature.

3.10 Novelty and Contribution of the Study in Disciplinary Area

This research is an empirical study regarding the complementarity of the forestry and agriculture as the fundamental livelihood components of majority of the people in the country living in rural hill areas. Therefore, it would have the better implication for the development of rural areas which is inevitable for the prosperity of country as a whole. This research is an exemplary one for researcher, development activists, policy makers and local stakeholders so that they can make plan and better implement strategy so as to contribute for the betterment of the rural settlement.

CHAPTER - IV

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction of the Study Area

Bethanchowk is one of the Rural Municipality(RM) located in hill region of Kavrepalanchok district of the Bagmati province and situated nearly 45 kilometer south apart from Kathmandu, a capital city of Nepal. According to the politico-administrative division, it has divided into 6 different wards based on the existing five different village development committees, namely; Chamrangbeshi for ward 1, Dhunikharka for wards 2 and 3, Chalaganesthan for ward 4, Chasingkharka for ward 5, and Bhugdeumahankal for ward 6. The total area coverage of this RM is 101 square km with the total population of 22,665 living 4,148 household in total (Bethanchowk Gaunpalika, 2076BS). This RM is surrounded by six different municipalities; where Panauti and Namobuddha municipalities are in north, Khanikhola RM in south, Roshi RM in east and Mahankal RM of Lalitpur district in the west part of the Bethanchowk.

The name of this RM has kept being based on the famous Bethanchowk Narayan temple situated in ward number one in a height of 3018 meter (some sources show 3800 meters) from the sea level. Actually, Bethanchowk is naturally rich in natural resources including varieties valuable tree species along with medicinal herbs such as; *Loathsalla*, *Thingresalla*, *Viswama*, *Arghauli*, *Jhyau*, *Sugandhawala*, *Chiraito*, *Majitho*, *Kurilo* and so on. Similarly, majority of the land areas of this RM is covered by forest and hence the livelihood of the people are closely connected to the agroforestry practices from the due course of time. The Tamang community predominates, with a blend of Brahmin, Chhetri, Indigenous, Janajati, and Dalit groups adding to its unity in cultural diversity. According to the data available in the final report of Household survey and statistical management of Bethanchowk RM (2076BS), this RM holds 30 registered agriculture forms along with a dozen of agricultural small market centers. Additionally, there are eight different NGOS actively working in the field of local development, agriculture & livestock promotion, environment protection, education and awareness as well as one commercial bank and three microfinance along with the 25 cooperatives to mobilize financial resources (Bethanchowk Gaunpalika, 2078BS). More interestingly, there are 25 Bal Bikash and 30 schools within 6 different wards of Bethanchowk which represents growing concern to the educational development as a basic foundation of development. Furthermore, there are 33 community

forestry users groups(CFUG) connecting about 4636 household where some households are aligned with more than one CFUGsand 5 Leasehold forest users group connecting 31 families (Division Ban Karyalaya, 2080BS). These figures demonstrate the growing importance of agroforestry as a fundamental source of livelihood in Bethanchowk RM.

The existing population status according to wards are shown in table 4.1.

Table 4.1

Ward-wise population distribution of Bethanchowk RM

Detail	Wards numbers						Total
	1	2	3	4	5	6	
Total no of Household	300	632	609	1046	761	800	4148
Total Male Population	877	1662	1529	2619	2310	2389	11386
Total Female Population	823	1669	1501	2631	2362	2403	11389
Total Population	1700	3331	3030	5250	4672	4792	22775
Female headed household	33	96	110	228	135	175	777

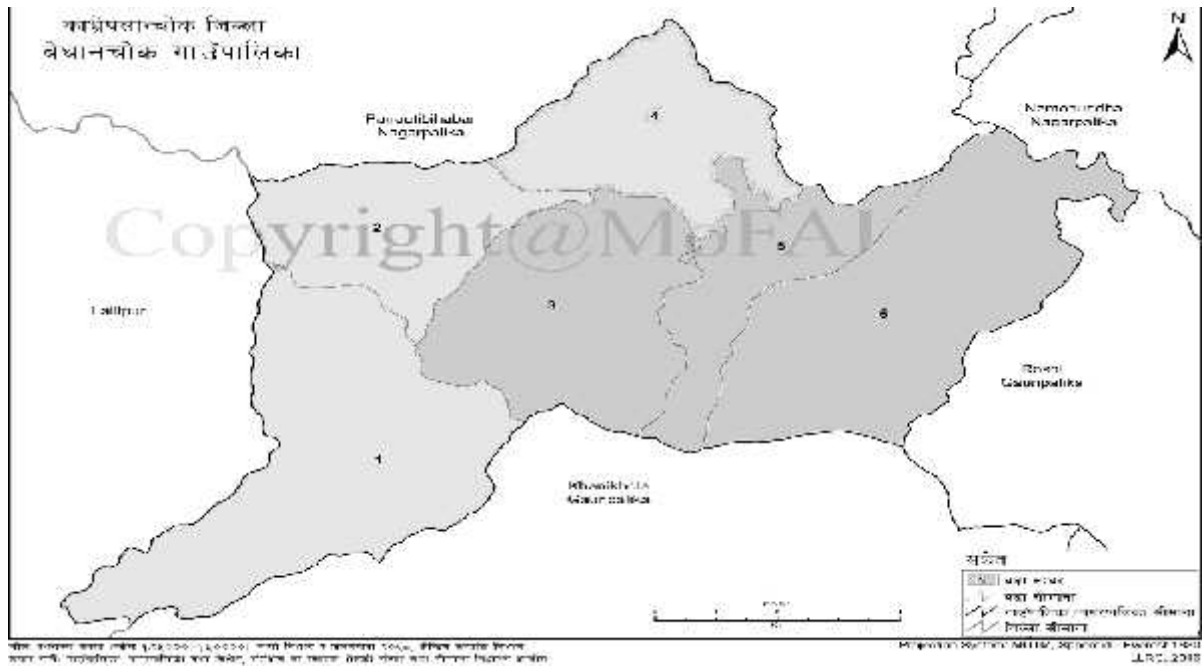
Source: Bethanchowk Gaunpalika, 2076BS

Table 4.1 demonstrate the total number of household and population distribution of the Bethanchowk RM. As shown in the table, ward number 4 occupies highest number of household and its respective population followed by the ward 6 and 5 respectively. The sex ratio of the population shown almost equal which might be the unique status comparing with entire local bodies of the country. However, the gender disparity persist significantly in the sense that there are only

The politico-administrative division of the RM also looks like straightforward and easy to analyze in the sense that it is limited only in 6 wards and divided according to the area comes one after another from ward 1 to 6. The overall structure and the land use pattern of the Bethanchowk RM are shown in the following two figures below:

Figure 4.1

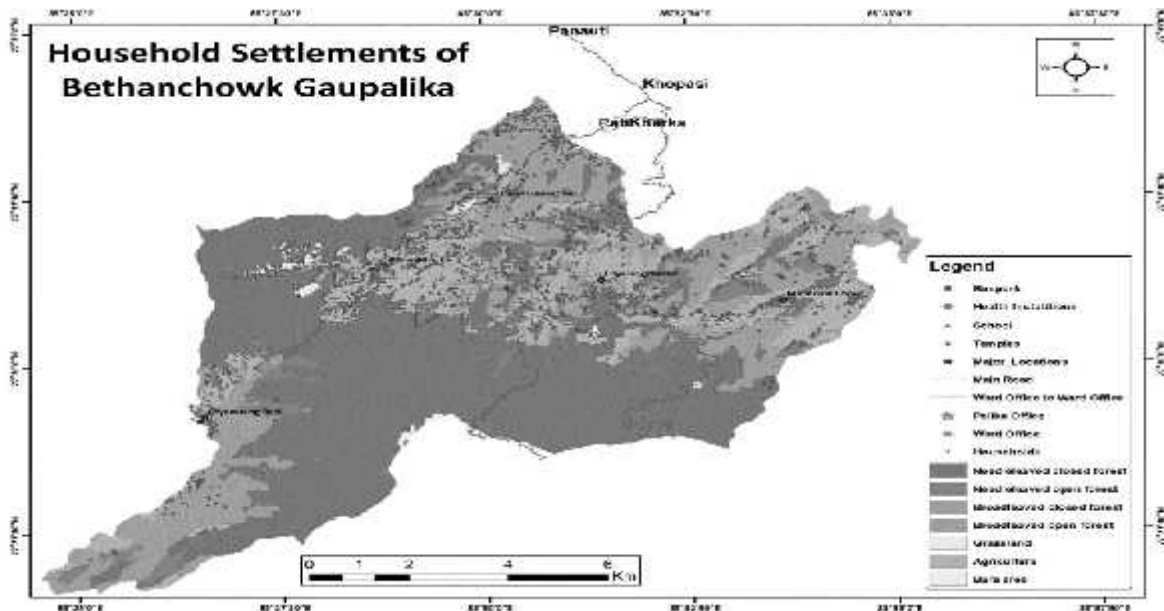
Politico-administrative map of Bethanchowk



Source: Municipal record, 2024

Figure 4.2

Land use map of Bethanchowk



Source: Bethanchowk Gaunpalika, 2076BS

Figure 4.1 and 4.2 demonstrate the administrative as well as land use status of the Bethanchowk RM. As shown in the figure 4.2, most of the areas are covered by the forest

whereas settlement and agriculture are distributed throughout the northern east part of the RM even some settlement are scattered to the south-west corner of the figure. It clearly shows that the settlement as well as agriculture to the entire area impossible to depart from the forest and exist as a complementary of livelihood.

4.1.1 Caste distribution

Caste distribution is the true reflection of the social structure through which it seems easy to predict the social and cultural integration among the different communities. In this regard Bethanchowk looks like a settlement dominated by ethnic community. The actual status of caste distribution are shown in table 4.2.

Table 4.2

Caste-wise distribution of household

Castes	Ward numbers						Total	Per cent
	1	2	3	4	5	6		
Tamang	112	148	151	690	572	551	2224	53.62
Brahmin	177	383	352	23	22	28	985	23.75
Chhetri	4	37	7	114	106	80	348	8.39
Newar	0	52	36	174	27	7	296	7.13
Magar	1	3	20	12	5	98	139	3.35
Kami	4	5	35	13	13	11	81	1.95
Damai	2	3	8	17	14	12	56	1.35
Others	0	1	0	3	2	13	19	0.46
Total	300	632	609	1046	761	800	4148	100

Source: Bethanchowk Gaunpalika, 2076BS

Table 4.2 represent the caste structure of Bethanchowk RM where more than half of the total population belong to Tamang community whereas Brahmin/Chhetri occupy nearly one third of the total household. Only one third of the total household are from all the other castes. It reveals that this RM is dominated by the Tamang community.

4.1.2 Agricultural status

Since Bethanchowk is considered as one of the fastest growing Rural Municipality of Bagmati province in Nepal mainly after the political restructure of the country, agriculture looks as a dominant source of livelihood through which rest of other sectors are depend on. This RM has been gradually improving with the commercial agricultural practices along with the better road connectivity throughout the entire areas for good transportation. Unfortunately, the unprecedented massive rainfall of 27 & 28th of September 2024, caused to happen the deadliest landslides; by which large numbers of individual houses, institutional buildings and thousands of planted fields & livestock destroyed along with the demise of nearly two dozen of people in Bethanchowk (Bethanchowk Gaunpalika, 2081BS). However, the existing status of agricultural domination can be shown in table 4.3.

Table 4.3

Ward-wise agricultural status of Bethanchowk RM

Household detail	Ward numbers						Total
	1	2	3	4	5	6	
Land use for agriculture	265	492	548	793	599	465	3162
Livestock holding	272	438	436	760	534	666	3106
Agriculture/Livestock as main source	263	405	449	587	464	644	2812
Persons with skill development training	19	49	29	23	64	25	209

Source: Bethanchowk Gaunpalika, 2076BS

Table 4.3 represents the agriculture related information of the ward-wise households of Bethanchowk. Almost three fourth of the total household (76.23 per cent) are using their land for agriculture and holding livestock as well. Similarly, two third of the household (nearly 68 per cent) consider agriculture and livestock as a prime source of livelihood. Similarly, there are remarkable number of manpower with skill development training in agriculture and livestock, however there exist variation in different ward having lowest 19 persons in ward - 1 to the highest 64 persons in ward 5 which reveals that people pay higher attention to agriculture as a prime source of livelihood.

4.1.3 Occupational status

Since, more than three fourth of the total household engage in agriculture sector as they use their land for agriculture and livestock (see table 4.3), the occupational diversity has also exist in the Muniipality. However, agriculture is predominant among all the occupation even remarkable number of the people are seen as students. The occupational status can be shown in table 4.4.

Table 4.4

Occupational distribution of the population in Bethanchowk RM

Types of occupation detail	Wards						Total
	1	2	3	4	5	6	
Agriculture/Livestock	940	938	1232	1921	1119	1852	8002
Students	336	1124	994	1441	1336	1594	6825
Paid workers	47	124	72	374	562	373	1552
Service	83	263	196	398	173	173	1386
Business	52	242	163	249	332	175	1213
Foreign employment	31	108	96	176	295	114	820
Unemployed	11	40	5	83	124	333	596
Industries	13	93	37	61	102	11	317
Pensioners	3	15	7	46	15	20	106
Others	184	384	228	501	514	147	1958

Source: Bethanchowk Gaunpalika, 2076BS

As shown in the table 4.4, agriculture/livestock occupies more than 35 per cent of the total population who primarily enjoy their lives in the field for cropping. Similarly, there is remarkable number of people who are working as daily paid workers even some people are still unemployed.

4.1.4 Nature of agricultural practice

Agriculture in Bethanchowk plays crucial role to sustain rural livelihood even though the limited number of people primarily following agriculture as a prime source of occupation. Some people prefer agriculture even if they don't have enough farmland to cultivate. The actual status of agricultural practice are presented in table 4.5.

Table 4.5

Status of agricultural population in Bethanchowk RM

Agriculture practices	Wards numbers						Total
	1	2	3	4	5	6	
In own land	922	902	1213	1879	1100	1847	7863
In rented land	18	32	12	0	7	0	69
Agriculture labour	0	3	0	42	11	4	60
Others	0	1	7	0	1	1	10
Total	940	938	1232	1921	1119	1852	8002

Source: Bethanchowk Gaunpalika, 2076BS

Table 4.5 demonstrate the nature of agricultural practice that are following by the farmers. Out of the total, all most 99 per cent farmers cultivate on their own land whereas some 69 people are working on the rented land. By comparing the data in different table above depict that about 76 per cent household are practicing agriculture and livestock whereas nearly 36 per cent of the working population are enough for crops production. That is how the intensive agricultural practice have been applying by the majority of the farmers at the field level.

4.2 Patterns and Trends of Agroforestry Practices

This sub-section provides a descriptive analysis of the primary participants who were selected as the sample for field level data collection. It examines the demographic and socio-economic characteristics of the respondents, including variables such as age, sex, cast, income and other fundamental information. These attributes are essential for contextualizing the study's findings and interpreting the broader implications of agroforestry practices on livelihood sustainability. Furthermore, this demographic and socio-economic data aids in

understanding the prevailing perceptions and practices related to agroforestry within diverse community settings. By analyzing these patterns, the study aims to establish a comprehensive understanding of how agroforestry contributes to sustainable livelihoods across varying socio-economic contexts.

4.2.1 Age and sex-based distribution of the participants

Age and sex status are taken as the very basic characteristics of the selected population by which the actual existence as an active respondent during the household visit can be analyzed. Because of the growing trend of out migration majority of the youths are unavailable during field survey. As a result, the contribution of the youth in agriculture and allied sectors especially in rural areas has been declining in recent days. This figure shows the acute shortage of work force in the future which exist as a major challenge to local as well as national government to deal with. The existing sex based status of the participants according to the age group are shown in the table 4.6.

Table 4.6

Age and Sex distribution of the participants

Age group of the participants	Gender		Total	Percent
	Male	Female		
15-30	14	9	23	6.46
30-45	44	24	68	19.11
45-60	67	36	103	28.93
60-75	75	23	98	27.53
75 and above	52	12	64	17.97
Total	252	104	356	100

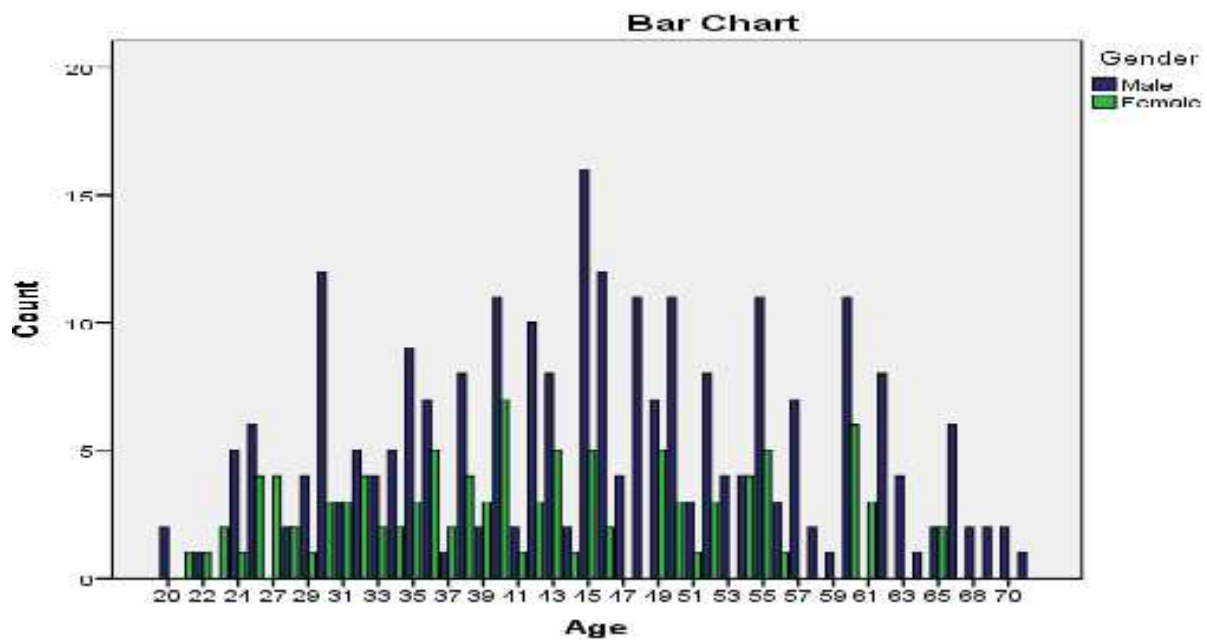
Source: Field survey, 2024

Table 4.6 demonstrate the age classification of the participants along with their respective sex category. Participation of the less than one-third in proportion by female means they are busy enough in everyday chores and usually hesitate to face outsiders till the date. On the other hand, the participants below 30 years of the age are only 6.46 per cent represents that there is acute deficiency of youth existence in the society who can contribute for household production and other task. Whereas, participants above 60 years exist nearly

half of the total means the sole responsibility of agroforestry handling belong to the old age people today. The sex and age-wise distribution of the participants are shown in the figure 4.3.

Figure 4.3

Age and sex distribution of the participation



The figure 4.1 represent the nearly normal distribution of age distribution of participants consisting high existence in middle age and gradual decline in above and below the age of 45 years in the center.

4.2.2 Caste/Ethnic categories with agro forestry practice

Caste and ethnicity is another component or social characteristics of the participants by which we can find out that whether agroforestry does vary with caste/ethnicity or other socio-cultural factors of not. For the simplicity of the analysis, the entire caste in the study area are divided into three categories. They are; Brahmin/Chhetry, Janajati which covers all the caste of Tamang, Pradhan, Shrestha, Magar, Rai, Thokar, Lopchan and Waiba, and the thire one is Dalit covering Bishwakarma, Damai and Nepali in the study area. Knowingly or unknowingly, people are practicing agroforestry from long course of time because of the nature and pattern of land and forest available. However, the duration are classified into four category and plotted the arguments of the participant in the table 4.7.

Table 4.7*Caste/Ethnic categories with agroforestry practice duration of respondents*

Agroforestry practice duration	Caste/ethnic categories of Respondents			Total
	Brhmin/Chhetri	Janajati	Dalit	
Since few years	7	51	0	58
5 to 10 years	20	40	3	63
Above 10 years	62	64	4	130
No exact ideas	23	76	6	105
Total	112	231	13	356

Source:Field survey, 2024

Table 4.7 depicts majority of the participants are belong to the Janajati category covering about 65 per cent of the total whereas Dalits are very few in number. In case of the agroforestry practice duration, the data shows that, 36.5 per cent participants are practicing such practice from more than ten years and about 30 per cent don't know exactly that when the agroforestry practice started even the accept they are practicing agroforestry. About one-third of the participants lately in a sense that they started new ways of farming by mixing forestry components and tried to intensify it for better advantages.

4.2.3 Education level and agroforestry knowledge

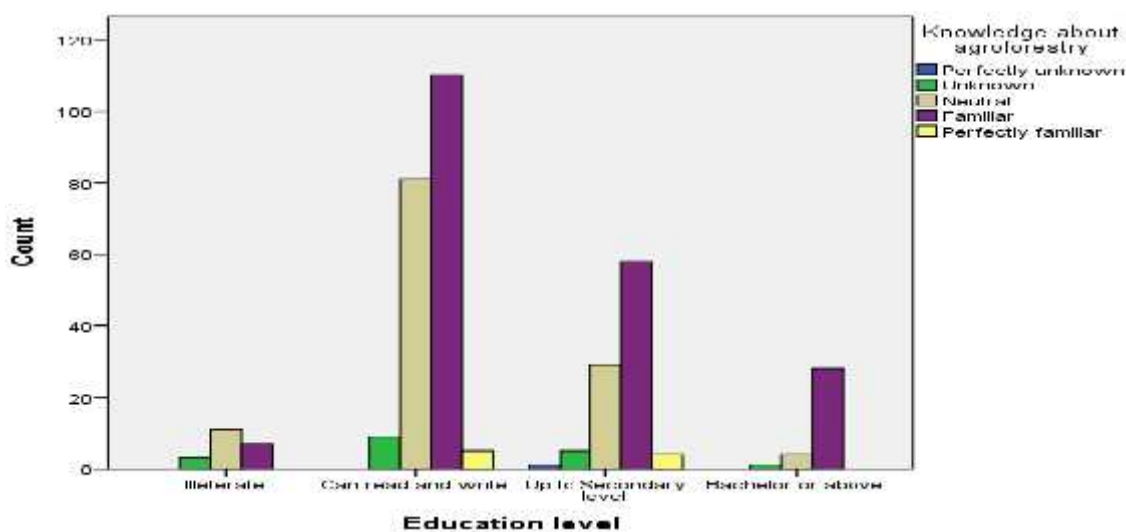
Education is one of the dominant prerequisites for qualitative as well as quantitative enlargement of the people's choice. However, it may vary from situation to situation and may exist the variation among person to person within a similar socio-physical condition too. Having better educational background, it is said that a person can play remarkable role to enhance agroforestry practices in applying new technology and inputs. But it does not mean that people with better agroforestry knowledge must possess good educational qualification. Because, people can learn the better practice of agroforestry from family, community or any other people applying good practice in the surrounding even they may not have any educational degree. The similar status are seen in my study area which can be shown in the table 4.8.

Table 4.8*Education level and knowledge of agroforestry*

Education level	Knowledge about agroforestry					Total
	Perfectly unknown	Unknown	Neutral	Familiar	Perfectly familiar	
Illiterate	0	3	11	7	0	21
Can read and write	0	9	81	110	5	205
Up to Secondary level	1	5	29	58	4	97
Bachelor or above	0	1	4	28	0	33
Total	1	18	125	203	9	356

Source:Field survey, 2024

The data in table 4.8 shows that the knowledge in agroforestry does not aligned with the educational level. Rather, they understand it by secondary means in the society with peer practice and other relations. It further clarify that formal degree to mandatory to learn and earn from agroforestry in rural areas of Nepal. In the table, the highest number of the participants 110 persons, who are well familiar with agroforestry are just the literate and can read and write only whereas just 33 persons are there having qualification bachelor and above. This status can clarify by the help of figure.

Figure 4.4*Educational level and knowledge on agroforestry*

In the figure 4.4, all the literate people are familiar to agroforestry because of its growing importance in people's livelihood.

4.2.4 Survival occupation and agroforestry knowledge

In general, the livelihood pattern of the people are measured by the occupation the have flowed even if it does not specify which one is better or worse off. However, the nature and trend of the occupation that people followd represents the level of living and access with the means of modern amenities to enjoy the comfort of life. Similarly, the knowledge about agroforestry provides the basic understanding of the people in which the components of agriculture and forestry merged together to produce the desirable outcomes. Those people, who are able connect their occupation with agroforestry found to be more empowered and progressive with compare to others. The relation of occupation and knowledge on agroforestry cam be sheen in the table 4.9.

Table 4.9

Main occupation for survival and agroforestry knowledge

Main occupation for survival	Knowledge about agroforestry					Total
	Perfectly unknown	Unknown	Neutral	Familiar	Perfectly familiar	
Daily wage labour	1	10	8	0	0	19
Basic agriculture	0	5	98	115	2	220
Commercial agriculture	0	0	0	44	7	51
Business	0	2	9	12	0	23
Service or others	0	1	9	32	1	43
Total	1	18	124	203	10	356

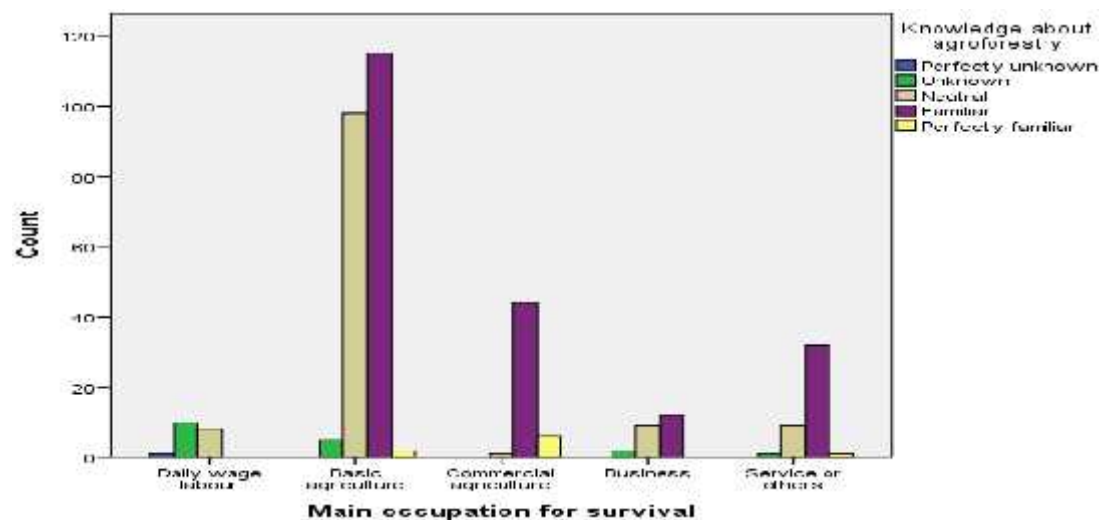
Source: Field survey, 2024

Table 4.9 shows the major occupations for survival along with the knowledge level about agroforestry in Bethanchowk. The data shows, nearly two third of the participants are familiar with basic concept of agroforestry regardless of the occupation. However, nearly 62 per cent of the people are primarily depends upon basic agriculture and some 14.32 per cent of them are involved in commercial agriculture. The role of other occupation found insignificant in the study area. The most noticeable issue is that, nearly 35 per cent of the

total are still neutral means unable to argue the idea about agroforestry even they realized that whatever they are practicing in the field is undoubtedly a form of agroforestry. Main occupation for survival against the knowledge on agroforestry can graphically represent in the following figure 4.5.

Figure 4.5

Main source of occupation and agroforestry knowledge



4.2.5 Source of agroforestry idea and its knowledge level

Idea of agroforestry and its knowledge level is a basic instrument to identify the nature and trends of agroforestry in the study population. Even it is not the common term to define for majority of the people, most of them literally agreed that it is aligned with their everyday life. The survey data show that all most none of them are perfectly unknown about agroforestry. The statistical representation of familiarity and its source of idea obtained from are shown in the table 4.10.

Table 4.10*Idea of agroforestry and its knowledge strength*

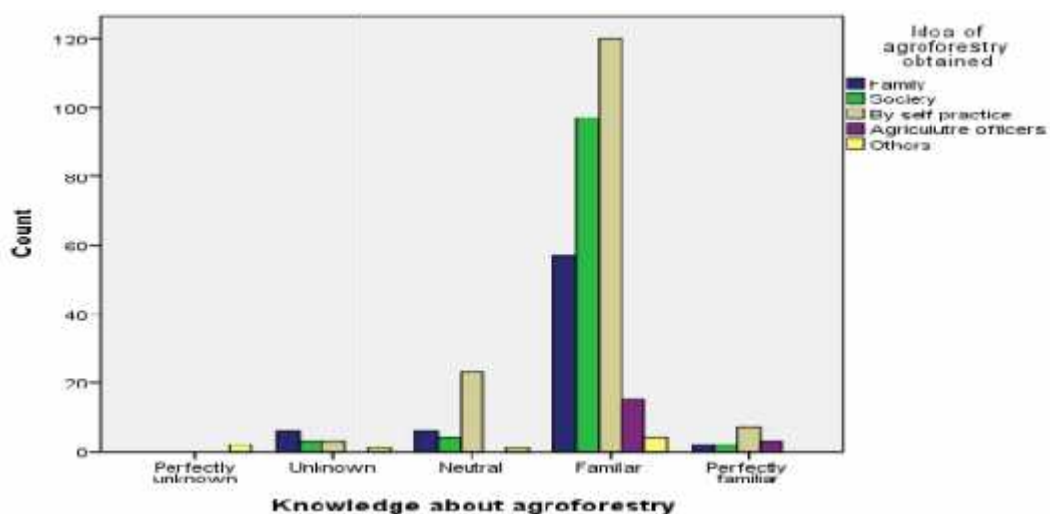
Knowledge about agroforestry	Idea of agroforestry obtained from					Total
	Family	Society	Self-practice	Agriculture officers	Others	
Perfectly unknown	0	0	0	0	2	2
Unknown	6	3	3	0	1	13
Neutral	6	4	23	0	1	34
Familiar	57	97	120	15	4	293
Perfectly familiar	2	2	7	3	0	14
Total	71	106	153	18	8	356

Source: Field survey, 2024

Table 4.10 represents the level of familiarity along with the source of agroforestry idea obtained from. As shown in the table, more than 80 per cent of the participants are familiar out of which most of them got the idea of agroforestry from their own practice followed by learnt from society and from family respectively. Some insignificant per cent of the participants obtained its idea from agricultural office and are perfectly familiar means, they are facing technical and knowledge assistance from skilled personnel of agroforestry. The graphical representation of the basic idea and the knowledge strength of the agroforestry is clearly shown by the figure 4.6.

In this regard, majority of the key informants argued that, the idea has come from due course of time with human civilization where people used to exploit various forms of forest products along with their cultivation and animal husbandry for basic survival even the scientific name of agroforestry has not been common in practice.

Figure 4.6



Knowledge level and idea of agroforestry obtained

As the peak shown in the bar chart of figure 4.6, the highest number of participants are simply familiar on agroforestry and the source of such knowledge primarily comes from family first.

4.2.6 Agroforestry practice duration and its major changes

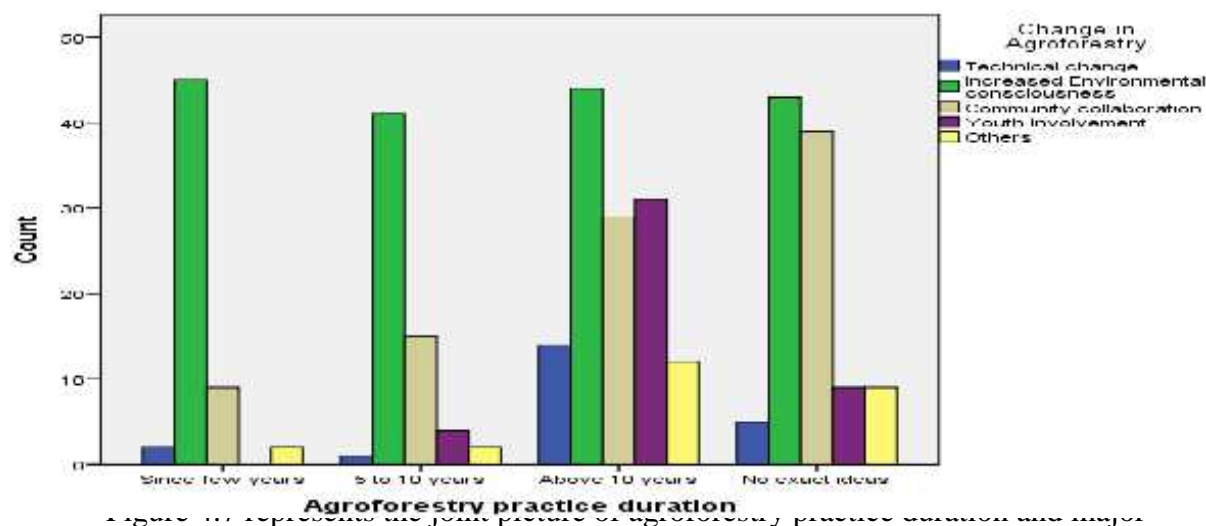
Agroforestry as a fundamental system of rural livelihood, people in the Bethanchowk are adapting new ways of cultivation by which they can make better choice for survival. Basically, even there are variation in the practice duration among the farmers, mainly four types of change in the agroforestry system are clearly realized by the people which also vary among communities and households too. However, the major change types along with the practice duration of agroforestry are shown in table 4.11.

Table 4.11*Agroforestry practices duration and major changes*

Agroforestry practice duration	Change in Agroforestry					Total
	Technical change	Environmental consciousness	Community collaboration	Youth involvement	Others	
Since few years	2	45	9	0	2	58
5 to 10 years	1	41	15	4	2	63
Above 10 years	14	44	29	31	12	130
No exact ideas	5	43	39	9	9	105
Total	22	173	92	44	25	356

Source:Field survey, 2024

The data in table 4.11 shows, there is constant increase in the environmental consciousness in the people regardless of the agroforestry duration which means people realized the importance of environment to ensure livelihood and other components. People exactly don't know that when agroforestry has been started but the realized the environmental awareness to cope with the changing context. Similarly, the community collaboration has also been realized by the participants through which they can learn and earn from own surrounding neighbors especially in case of accessing new tools, techniques, seeds, and fertilizers for production. The status can clearly be shown in the following figure.

Figure 4.7*Agroforestry practice duration and major changes*

changes identified. Given the four basic types of change like technical change, environmental consciousness, community collaboration and youth involvement as well as some unidentified, there is domination in the environmental consciousness among the people regardless of its start duration.

4.2.7 Types of agroforestry practices along with types of trees in farming

Since, the agroforestry practice cannot be found uniform throughout the country and same in case of Bethancowk, the conceptual classification depending upon the components mixed within in the study area are classified into 4 different agroforestry types along with the types of trees are cross tabulated on the following table 4.12. The four types of agroforestry that are practiced in the study area are:

1. Agrosilvic-ulture (crop with tree/plant)
2. Agrosilvopastoral (Crop, fruits trees & livestock with pasture)
3. Silvopastoral (Trees, livestock with pasture)
4. Home Garden (Crops, trees with livestock)

Table 4.12

Agroforestry types and types of tree planted

Types of tree in Agroforestry	Agroforestry types					Total
	Agrosily- culture	Agrosilvo- pastoral	Silvo- pastoral	Home Garden	No idea	
Trees for timber	38	20	6	21	0	85
Fruit trees	15	51	2	12	1	81
Multipurpose trees	7	33	5	14	1	60
Shedding trees(Chhahari)	2	3	3	12	0	20
Forage trees(Dale ghash)	17	21	15	53	4	110
Total	79	128	31	112	6	356
Per cent	22.19	35.95	8.71	31.46	1.69	100.0

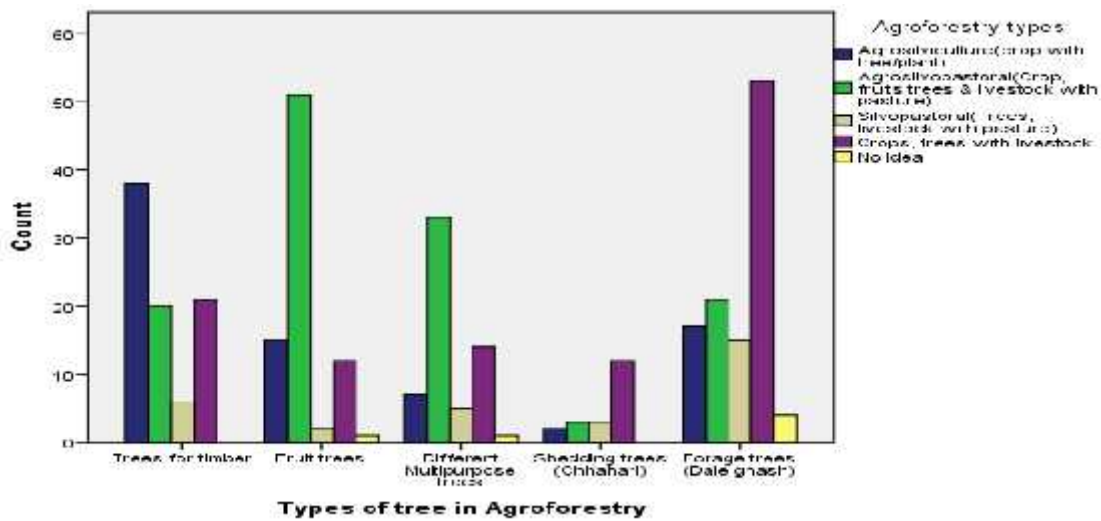
Source: Field survey, 2024

Overall, the data (Table 4.12) emphasizes the importance of various tree species in agroforestry practices and highlights the predominant trends among practitioners. Understanding these patterns is essential for promoting sustainable agroforestry practices that

align with local agricultural needs and environmental conditions. As shown in the table, majority of the participants practicing agrosilvopastoral covering nearly 36 per cent of total practice follow by the home garden occupying 31.46 per cent of the total agroforestry. However, some insignificant portion of participants are still unknown about the type they have been using. The structure can be viewed in the figure 4.8.

Figure 4.8

Agroforestry type with major type of trees



4.2.8 Status of agroforestry practice change over time

Practicing agroforestry is not the static concepts but it has been changing over time with the inception of the technology, ideas and the awareness as well as perception of the people over the time. People become more conscious and informed about economic as well as ecological challenges they have been facing throughout the time. That is why, agroforestry practice keeps on changing to cope with the existing circumstances. The actual change pattern followed by the participants are shown in table 4.13.

Table 4.13*Change in agroforestry over time*

Major change obtained	Frequency	Per cent	Cumulative per cent
Technical change	22	6.2	6.2
Increased Eco-consciousness	173	48.6	54.8
Community collaboration	92	25.8	80.6
Youth involvement	44	12.4	93.0
Others	25	7.0	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.13 depicts that out of total, nearly half of the participants changed their agroforestry practices as a result of increased environmental consciousness. Which means people become more aware on the environmental issues. Similarly, one fourth of the total participants argued the community collaboration as a way of change in agroforestry that means people are united to cope with the livelihood challenges through changed practice of agroforestry. The information obtained from key informants suggest that due to the accessibility of the new technology and scientific management of agriculture and forestry, new generations are also inclined to agroforestry as a better option of family wellbeing. In this regard participant 4 argued as follows:

Informant 3: *"We have been practicing agroforestry widely because we cannot separate our farming from forest. In fact, there is wide difference then and now. In the past agriculture was just for survival and now as a convenient source of money income. As a result of using modern agroforestry techniques, forest are connected with commercial livestock and farming to make money. As the income increases, people start alternative use of energy sources and other comforts. That is how it has been a good way to improve our wellbeing."*

4.2.9 Nature of change with adopting agroforestry

People believe that agroforestry has gradually aligned with professional ways of life and good way to make money. They have realized that as a result of modern agroforestry practices, there has been remarkable change in the income of the people. Even if the nature

of change in income level vary from person to person, people have realized some minimal to significant growth in income level of the people demonstrate the valid role of agroforestry in economic condition of the people that are shown in table.

Table 4.14

Percentile change in income after adapting agroforestry

Change per cent	Frequency	per cent	Cumulative per cent
No change	8	2.2	2.2
Less than 25%	86	24.2	26.4
25-50%	124	34.8	61.2
50-75%	66	18.5	79.8
75 % or above	72	20.2	100.0
Total	356	100.0	

Source:Field survey, 2024

Table 4.14 represent the realization of the participants during field survey regarding their growth in income after adapting modern agroforestry. The data reveals that over 60% of participants experienced less than 50 per cent growth in their income, while nearly 40% achieved an income increase exceeding 50 per cent. That is how people realized agroforestry as a good way to increase income level. Therefore, it can be concluded that income would be one of the fundamental components for making livelihood sustainable in a sense that people would have better access to the rest of the other opportunities with better income so that they can handle everything wisely.

4.2.10 Reason behind practicing agroforestry

In recent days, agroforestry become one of the common means of livelihood due to the connection of agriculture and forestry as complementary part of survival of majority of the people mostly in rural areas. More specifically, the changing notion of development, inclined toward the jargon of clean development like; nature friendly, carbon fore, greenery, sustainable and so on. However, people consider some specific reasons behind adapting agroforestry on their plot of land are shown in table 4.15.

Table 4.15*Reason behind adapting agroforestry*

Major reasons	Frequency	Percent	Cumulative Percent
Improve soil productivity	168	47.2	47.2
Enhance biodiversity	40	11.2	58.4
Stable climate	47	13.2	71.6
Food security and income growth	66	18.5	90.2
No clear idea	35	9.8	100.0
Total	356	100.0	

Source: Field survey, 2024

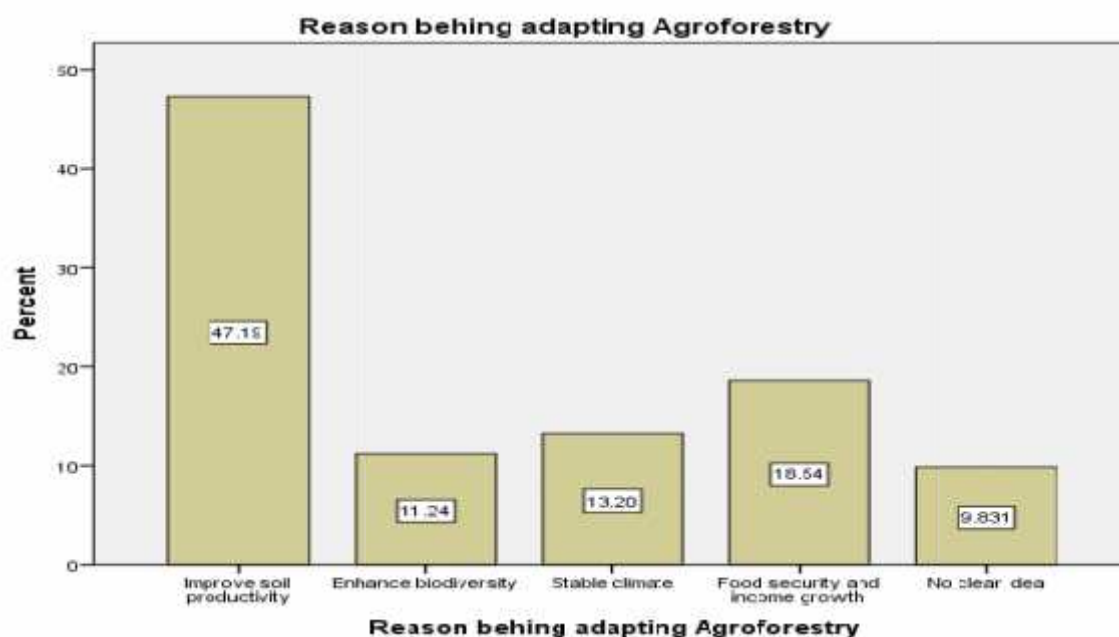
As shown in the table 4.15, there are some five major reasons behind adopting agroforestry on their farmland. Among them about half of the participants accept that agroforestry is the good means to improve soil productivity by ensuring organic farming through various forest services. Similarly, some nearly one fifth of the participants argued that it is the best possible way to strengthen food security and income growth.

The information obtained from the key informant supports the arguments in the sense that agroforestry is the best way to food security and income stability and hence it has to be widely acknowledged by every individuals in the rural community where other alternatives of livelihood are rare and insignificant. Furthermore, some photographs collected during field observation clearly demonstrate and justify the appropriateness of adopting agroforestry in the region because of the fact that every agricultural land are surrounded by the forest area and working as the backup for farming system in terms of fertilizer, water supply and other purpose such as pasture and agricultural inputs. This represents the indispensable use of forestry for agriculture and animal husbandry (See annex -I). This argument agree with the findings of Dhakal et al., (2012); Pandit et al., (2014) and Poudel et al., (2021) focusing on the mid hill cases of the country.

The response of the participants at the field survey regarding the adoption of agroforestry are clearly represented by figure 4.9.

Figure 4.9

Major reasons of practicing agroforestry



One of the key informants regarding the reason behind adopting agroforestry is quoted as follows:

Participant 13: *Farmers are motivated by the interdependence of agriculture, forestry, and livestock. Agroforestry provides essential agricultural inputs, organic fertilizers, and diversified income sources. The system reduces costs, increases productivity, and ensures ecological stability, making it indispensable for rural livelihoods.*

In this way, this section describes the existing pattern and trend of agroforestry in the study area from different viewpoints connecting with different household characteristics as independent variables which can play a significant role.

4.3 Role of Agroforestry in Changing Rural Livelihood

Rural livelihood in Nepal is generally characterized by the predominance of an agrarian system, diverse in nature which is largely shaped by the sloping topography and socio-economic circumstances. More specifically, the livelihood in the Betahanchowk of Kavrepalanchok district in Nepal is fundamentally composed up of collaborative efforts of different components such as agriculture, livestock and forestry along with small scale

economic as well as environmental outcomes. The major contribution of agroforestry that are perceived by the people in Bethanchowk are listed depending on the preference of people in the table 4.16.

Table 4.16

Contribution of agroforestry in household

Major contribution	Frequency	Percent	Cumulative Percent
Income diversified	81	22.8	22.8
Food security	84	23.6	46.3
Increase employment	79	22.2	68.5
Increase land productivity	78	21.9	90.4
Reduced cost of production	32	9.0	99.4
No idea	2	.6	100.0
Total	356	100.0	

Source: Field survey, 2024

The table highlights that most respondents value agroforestry for its economic (income diversification, employment) and food security contributions. While environmental benefits like land productivity are also remarkably recognized whereas, cost reduction seems less apparent, possibly due to the need for initial investments in agroforestry. To strengthen agroforestry adoption in Nepal, government programs could emphasize its economic and food security benefits while promoting sustainable practices that further reduce production costs. Expanding community awareness through agricultural training and subsidies can enhance its adoption and long-term sustainability.

4.3.2 Additional advantage served by agroforestry

In general, people perceive agroforestry as a main stay of majority people in the study area where no farm output seems possible in absence of the forest services. As a complementary relation between agriculture and forestry, agroforestry facilitates varieties of tangible benefits to the people. The perception regarding the benefit obtained from the agroforestry are enlisted by the help of table 4.17.

Table 4.17*Benefits obtained from agroforestry*

Benefit types	Frequency	Percent	Cumulative Percent
Easy for firewood & timber	208	58.4	58.4
Reduced deforestation	83	23.3	81.7
Comfortable livelihood	12	3.4	85.1
Social integration	8	2.2	87.4
Increased biodiversity	45	12.6	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.17 demonstrate the range of benefits entitled by adapting agroforestry in the study area. Since, agroforestry makes easy for firewood and timber prefer by nearly 60 per cent of the participants, means majority household rely on agroforestry for consumption needs whereas, social integration occupies less significant preference. The cumulative Percent shows that the first two categories account for over 81.7 per cent of responses, emphasizing that people primarily value agroforestry for its direct, tangible benefits like firewood, timber, and act to reduced deforestation. The relatively low recognition of social and ecological benefits suggests a need for awareness campaigns to highlight the full spectrum of agroforestry's contributions. In this regard one of the key informant argued as followed:

Informant 6: *Joint supply from agriculture and forestry make good income sources.*

Protected water sources provide enough time to involve in income generating activities that make food security along with stable income.

4.3.3 Physical and financial support obtained for agroforestry

Even agroforestry practice seems common to the participants, the organized and scientific approach of agroforestry has not been well identified by majority of them. Whatever they have hold based on the conventional knowledge, might be the causes due to which people are still far from its materialization. Basically, nearly half of the participants responded no any support obtained from any institutions and those who obtained some

supports were very basic and irregular. The actual response of the participants are shown in the table 4.18.

Table 4.18

Support for agroforestry with supporting authority

Support for Agroforestry	Supporting authority for Agroforestry						Total
	No support	Agriculture office	Forest office	NGO/INGOS	Local level(Palika)	Others*	
No	157	0	0	0	0	0	157 (44.1%)
Yes	0	27	19	20	117	16	199(55.9%)
Total	157	27	19	20	117	16	356 (100.0%)

Source: Field survey, 2024

*Others covers support from Dhulikhel hospital, private business entity.

The majority of respondents (55.9%) reported receiving nominal support for agroforestry, with local level (Palika) being the largest source of support whereas, other authorities like NGOs, agriculture offices, and the forest office have a smaller role, contributing less to agroforestry support. Out of total, 44.1 per cent of respondents report no support, which indicates a significant gap in agroforestry assistance, especially from higher authorities or external organizations. The basic implications is that there seems to be a strong local level influence on agroforestry support, suggesting that community-based or decentralized approaches could be more effective in fostering agroforestry practices. This finding supports the arguments of focusing on the need of suitable policy, governmental focus and training program for ensuring sustainable outcome that eventually help to overcome different kinds of physical, financial and awareness barriers (Poudel et al., 2022; Dhakal et al., 2022).

4.3.4 Perception on the role of agroforestry in avoiding crisis

Agroforestry is said to be holistic solution that addresses several crises such as; climate change, food security, economic resilience, and biodiversity loss. By promoting sustainable agricultural practices, agroforestry helps reduce environmental degradation, improve livelihoods, and build stronger, more resilient communities. It is a key strategy for

tackling both current and future global crises related to environmental sustainability and socio-economic development. The primary response of the participants keeping in 5 layer Likert scale are presented in table 4.19.

Table 4.19

Agroforestry to improve resilience on economic & environmental shocks

Response scale	Frequency	Percent	Cumulative Percent
Strongly disagree	5	1.4	1.4
Disagree	9	2.5	3.9
Neutral	52	14.6	18.5
Agree	201	56.5	75.0
Strongly agree	89	25.0	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.19 depicts that the majority of participants are supportive towards the statement that agroforestry improve economic and environmental resilience with 56.5 per cent agreeing along with one-fourth participants strongly agreed whereas only a small Percent of them disagree (3.9%) or remain neutral (14.6%). This indicates a generally favorable perception among participants toward the argument under consideration.

4.3.5 Perception regarding the role of agroforestry to strengthen rural livelihood

Agroforestry in the current study area has taken as basic source of mainstay because of the resource strength and the tradition people maintain. Therefore, it has been a part of life by which most of the people in the study area pass through and reveal the importance of mixing the components of agriculture and forestry for survival. As a result, people perceive it to strengthen livelihood in rural areas. The actual perception of the participants are shown by the help of table 4.20.

Table 4.20*Perception regarding the role of agroforestry to strengthen rural livelihood*

Response scale	Frequency	Percent	Cumulative Percent
Strongly disagree	6	1.7	1.7
Disagree	4	1.1	2.8
Neutral	38	10.7	13.5
Agree	230	64.6	78.1
Strongly agree	78	21.9	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.20 demonstrate the overwhelming positive sentiments among participants consisting nearly 86 per cent of the total response whereas only insignificant proportion of the participants have expressed disagreement means minimal negative feedback. On the other hand, some 20.7 per cent participants are neutral means still some people are indifference regarding the strength of agroforestry on rural livelihood. Therefore, this table reflects the highly favorable collective opinion from the participants. It is better to assort the actual idea of key informant survey as given below:

4.3.6 Role of agroforestry for controlling soil erosion, flood and landslides

Agroforestry has been taken as a source of mainstay not just because of its productive importance, rather it also provide the protective services from different kinds of natural disaster like top soil erosion, landslides and flood. The reason behind is that the deep and extensive root systems, ground cover from mulch and terracing effect on sloped land slow down the effect to soil erosion. Similarly, trees and vegetation of agroforestry system absorb significant amount of rainwater as well as acts as buffer zones along waterways slow down water flow help mitigating flood risks. Additionally, the prevention of the landslide is possible through planting trees in sloppy terrain strengthening soil structures and enhances landscape stability and mitigates other hazards too. The perception regarding such ecological services are shown in the table 4.21.

Table 4.21*Agroforestry to protect from soil erosion, flooding, or landslides*

Response scale	Frequency	Percent	Cumulative Percent
Strongly disagree	6	1.7	1.7
Disagree	11	3.1	4.8
Neither agree nor disagree	81	22.8	27.5
Agree	164	46.1	73.6
Strongly agree	94	26.4	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.21 depicts that most of the participants are inclined to the positive response covering nearly three-quarters of the entire responses demonstrate the broad approval. On the other hand, only 4.8 per cent showing negative response means there is minimal disagreement whereas, there are notable proportion of the participants remain unclear or uncertain about the environmental role of agroforestry possibly due the lack of conceptual clarity, relevancy of may be lack of personal experiences.

4.3.7 Perception regarding productivity role of agroforestry

The knowing facts behind applying agroforestry in farmland is undoubtedly because of its productivity importance through which people can ease their survival. Mixing forest components with agriculture jointly contributes to avail organic inputs for agriculture that ensure larger productivity. The perception of the participants are labeled in table 4.22a.

Table 4.22a*Improvement in farm productivity by Agroforestry*

Response scale	Frequency	Percent	Cumulative Percent
Strongly disagree	5	1.4	1.4
Disagree	34	9.6	11.0
Neither agree nor disagree	43	12.1	23.0
Agree	189	53.1	76.1
Strongly agree	85	23.9	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.22a reflects more than three-quarter positive response consisting 53.1 per cent agree and about 24 per cent strongly agree means participants support is the overall approval on the statement of productivity improving role of agroforestry. However, above 12 per cent indifference response and 11.0 per cent disagreeing proportion indicates relatively small but noticeable level of uncertainty and disagreement. However, the surveyed population showing favorable positive feedback regarding the role of agroforestry to production.

Similarly, there is positive correlation between knowledge about agroforestry and improvement in farm productivity because of the familiarity of farmers to the new ways of farming through agroforestry. The status are summarized by the help of correlation table.

Table 4.22b*Correlations between agroforestry knowledge and farm productivity*

Knowledge about agroforestry/ Improvement in farm productivity by Agroforestry	Knowledge about agroforestry	Improvement in farm productivity by Agroforestry
Pearson Correlation	1	.322**
Sig. (2-tailed)		.000
N	356	356
Pearson Correlation	.322**	1
Sig. (2-tailed)	.000	
N	356	356

** . Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation value of 0.322 indicates a moderate positive correlation between the two variables. The moderate positive correlation suggests that individuals with better knowledge of agroforestry are more likely to acknowledge its potential to improve farm productivity. This highlights the critical role of education and awareness programs in promoting agroforestry as a tool for enhancing agricultural output. Increasing farmers' understanding of agroforestry techniques can significantly contribute to higher productivity through better land management, soil fertility improvement, and crop diversification.

4.3.8 Responsibility to promote agroforestry practices to reduce crisis

It is obvious that agroforestry is crucial practice to make livelihood comfortable through the mixture of forest components with agriculture. Realizing the growing importance, people started applying agroforestry practice as a means to improve their livelihood and hence consider themselves responsible to strengthen its outcome. The perception of the participants regarding the responsibility to enhance agroforestry that could minimize vulnerabilities are plated in table 4.23.

Table 4.23

Responsible authority to promote agroforestry and reduce vulnerabilities

Responsible authority	Frequency	Percent	Cumulative Percent
Ourselves	209	58.7	58.7
Community	48	13.5	72.2
NGO/INGOs	4	1.1	73.3
Local bodies	88	24.7	98.0
Federal government	7	2.0	100.0
Total	356	100.0	

Source: Field survey, 2024

As shown in the table 4.24, nearly 60 per cent of the selected population believe themselves as primarily responsible to promote agroforestry means there is inner desire to adapt by sowing own accountability whereas one-quarter of them expect some initiation from local bodies showing constant trust and expectation to decentralized governance. In this regard, participant thought some considerable collective role of community rather than some less significant role of NGO/INGOs and federal governance suggesting limited expectation

form outside. The data indicates that people strongly prioritize personal responsibility, with supplementary roles for local bodies and the community suggests a preference for local and self-driven solutions.

4.3.9 Relationship between change in agroforestry and agricultural productivity

Of course, agroforestry seems to be a changing phenomenon and keeps on changing over time with the access and advancement of new technologies and management skills. Participants argued differently to the different factors that make change in agroforestry possible. There are some consciously selected five different factors to change agroforestry practices and labeled differently by the participants which are shown in table 4.24.

Table 4.24

Change in agroforestry with improvement in farm productivity

Change in Agroforestry	Improvement in farm productivity					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Technical change	0	1	3	13	5	22
Increased Eco-consciousness	1	13	17	69	73	173
Community collaboration	2	16	16	53	5	92
Youth involvement	0	2	3	37	2	44
Others	2	2	4	17	0	25
Total	5	34	43	189	85	356

Source: Field survey, 2024

The table 4.24 clearly depicts the capture of the contributors to strengthen agroforestry. The data highlights the strong recognition of environmental consciousness showing moderate to high agreement indicating crucial role for farm productivity along with the significance importance to community collaboration. On the other hand some 44 participants agreed to youth involvement means engaging youth is beneficial but less impactful whereas technical change was less recognized. This data entirely reflects a greater preference for socially and environmentally integrated approaches rather than unspecified and

technical approaches in agroforestry practices. The aggregate responses can be clearly shown by the figure 4.11.

Figure 4.11

Improvement in farm productivity through agroforestry change

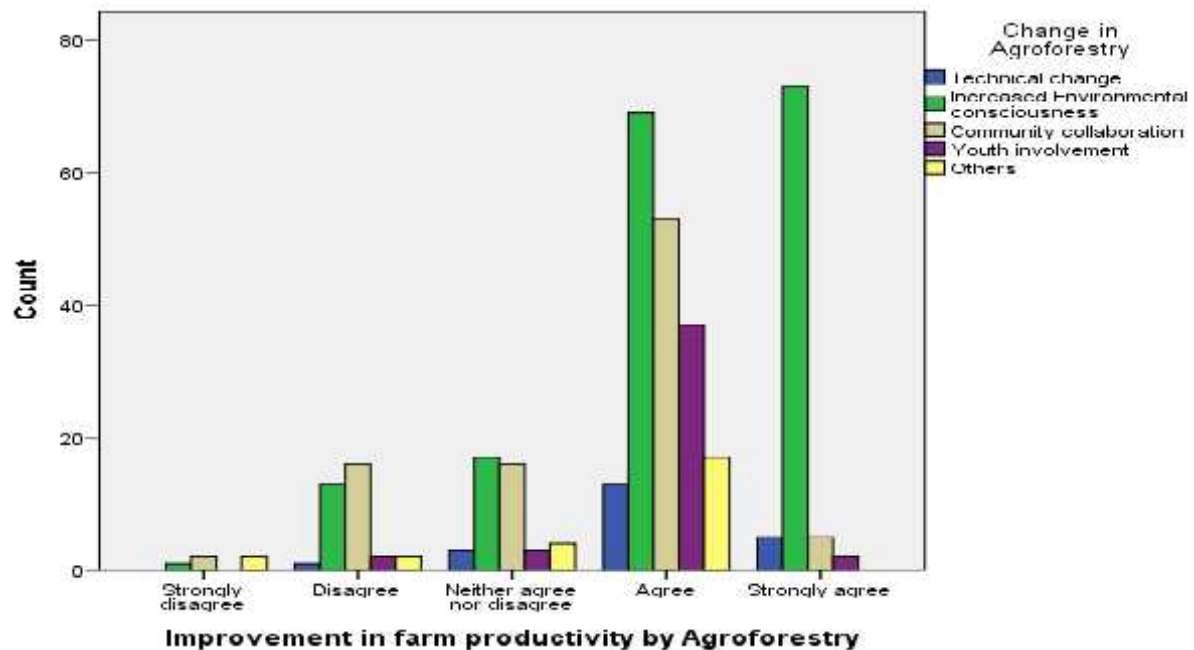


Figure 4.11 clearly demonstrate that there is greater concentration of the participants to agree or strongly agreed perception rather than disagreement or indifference.

4.3.10 Support obtained and productivity growth by agroforestry

People in the Bethanchowk are already convinced that agroforestry contribute for growing productivity. However, the support provided by different agencies may be private or public is not similar to each areas and comprises variety of positive or negative responses. Majority people argued that agroforestry contribute in farm productivity even if there are no any support. However, the data shows that local Palikas are responsible to provide fundamental support to promote agroforestry whereas some sorts of supports come from NGO/INGOs which is less visible with compare to supports from governmental agencies. The true response of the participants are shown by the help of table 4.25 and figure 4.12.

Table 4.25

Supporting authority for agroforestry and improvement in farm productivity

Supporting authority for Agroforestry	Improvement in farm productivity by Agroforestry					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
No support	4	30	23	79	21	157
Agricultural office	1	0	3	16	7	27
Forest office	0	2	2	14	1	19
NGO/INGOS	0	0	3	17	0	20
Local level(Palika)	0	2	10	51	54	117
Others	0	0	2	12	2	16
Total	5	34	43	189	85	356

Source: Field survey, 2024

Overall, the data highlights that local-level governance (Palika) plays a critical role in improving farm productivity through agroforestry, supported by moderate contributions from agricultural and forest offices. Even without formal support, many respondents reported positive productivity outcomes, reflecting possible reliance on self-initiative or community-driven efforts. Institutional collaboration and integrated policies could enhance agroforestry's effectiveness further.

Figure 4.12

Improving farm productivity with supporting authority to agroforestry

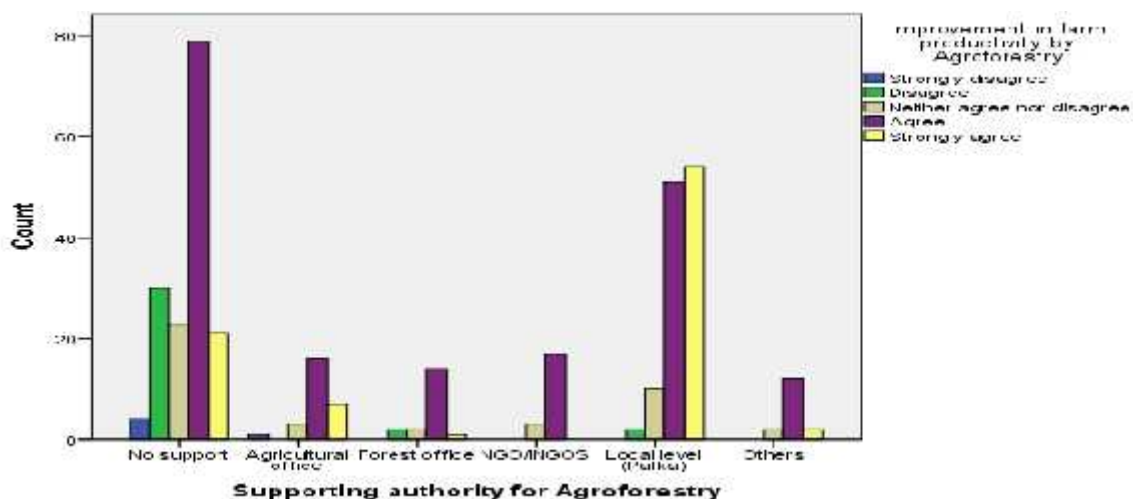


Figure 4.12 clearly shows that majority of the participants are behind the support of any authority whereas the local Palika are viewed as dominant support providers to the farmers that encourage them to enhance productivity.

4.4 Agroforestry System in Achieving Sustainable Livelihood

4.4.1 Sustainability components of rural livelihood

The sustainability components of agroforestry for rural livelihoods in Bethanchwok, Kavre, Nepal, can be categorized into environmental, economic, and social components. Each of these components contributes to livelihood sustainability, ensuring long-term productivity and well-being. Each of these three components constituted with separate respective sub-components by which we can measure the status and strength of livelihood sustainability in practice. For instance; environmental sustainability is outermost important components that composed with the elements like; soil conservation, water resource management, forest conservation and biodiversity preservation. Each of these elements are formally or informally addressed by the proper agroforestry management practice that has found in the field observation during household survey and from the information obtained from the key informants interview by the researcher that are supported by the concerned statistical information enclosed in the previous as well as this chapter too. Furthermore, the economic components of livelihood sustainability are identified as employment, income diversification, and food security are well identified in this research. Likewise social components like social equity, empowerment and knowledge sharing practice are identified as crucial factors to strengthen livelihood sustainability even if some moderating elements like; better education & training to farmers, market accessibility and appropriate government policy & support seems insufficient in the study area. However, this study tries to sketch the true figure of agroforestry practice for making livelihood sustainable in rural areas where more than three-fourth of the population are depending upon agriculture as a fundamental occupation with having more than 80 per cent of forest coverage to its total land in Bethanchowk (Kavre Division Ban Karyalaya, 2080BS; Bethanchowk Gaunpalika, 2076BS).

4.4.2 Agroforestry as an appropriate means for livelihood sustainability

Composition of Nepalese economy is agricultural predominance by which majority of the people are engaged with more or less conventional farm practices. As a conscious mixture of the different components of agriculture and forestry, agroforestry in Nepal supports

sustainable livelihoods by enhancing agricultural productivity, promoting environmental conservation, and strengthening socio-economic resilience, making it a vital strategy for rural development and sustainability. Keeping in view, the current research intend to delve with the appropriateness of agroforestry for maintaining livelihood sustainability. During the field survey, the multiple questions regarding the sustainability role of agroforestry have been asked to visualize the public perspective on sustainability measure of agroforestry are presented in table 4.26.

Table 4.26

Agroforestry for livelihood sustainability with main occupation for survival

Appropriateness of agroforestry for livelihood sustainability	Main occupation for survival					Total
	Daily wage labour	Basic agriculture	Commercial agriculture	Business	Service/ others	
Sufficiency of farmland	10	114	30	9	18	181
Sufficiency of forest	3	54	11	2	5	75
Appropriate strategy	3	12	1	1	6	23
Absence of other means	3	40	9	11	14	77
Total	19	220	51	23	43	356

Source: Field survey, 2024

As shown in the table 4.26, majority of the participants were engaged in basic agriculture perceive agroforestry as crucial means because of sufficiency of farmland by 114 persons whereas some 54 thought the sufficiency of forest they have. Which means the agroforestry complements traditional farming by enhancing farm productivity and providing essential resources like fuel wood and fodder. Likewise, commercial agriculture has preferred by 51 participants means agroforestry supports for intensive agriculture through better land use and environmental conservation. Overall, the agroforestry is considered as relevant for those who are following basic and commercial agriculture due to the availability of sufficient farmland and forest whereas, it provides alternative for vulnerable group like wage labour too. This finding supports the arguments of Ghimire et al., (2024). They have also concluded agroforestry system as an essential means for agricultural advancement, enhanced economic

opportunities and supporting environmental consciousness to the people. The status are further presented by the help of figure 4.13.

Figure 4.13

Appropriateness of agroforestry with main source of occupation for survival

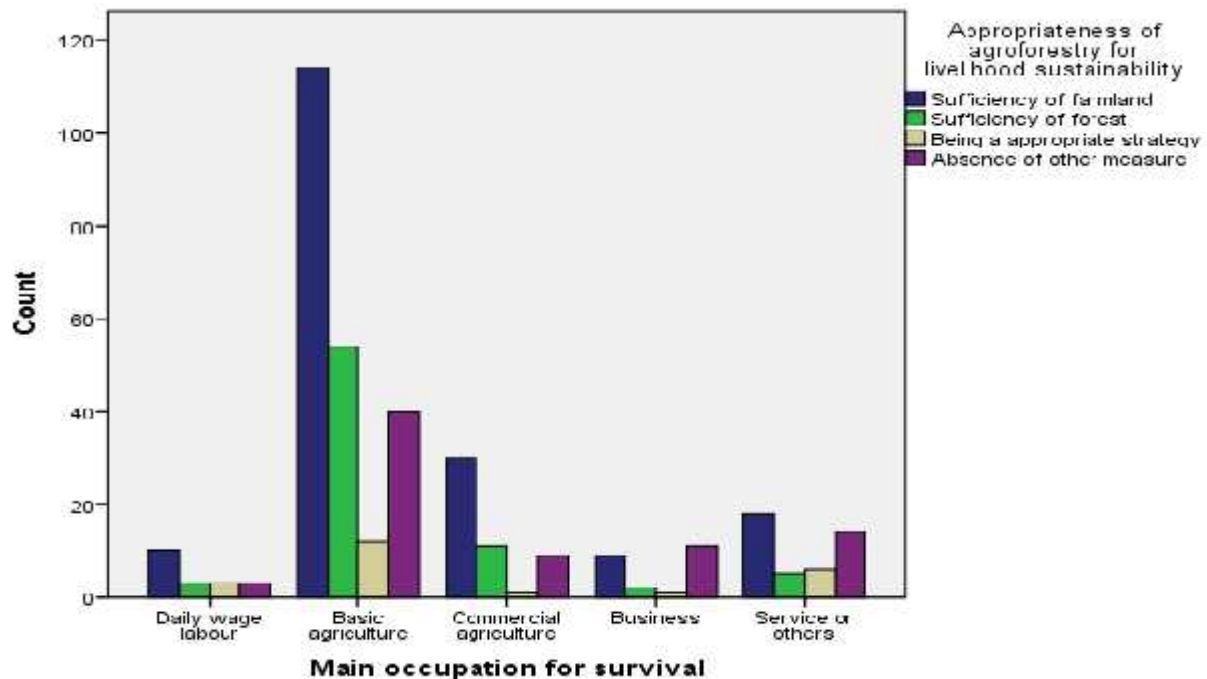


Figure 4.13 clearly shows that preferring basic agriculture has seen as a result of sufficient farmland they hold for farming.

Focusing the importance of agroforestry for sustainable livelihood, one of the key informant argued that;

***Participant 3:** Agroforestry promotes sustainability by ensuring continuous agricultural inputs, reducing dependency on external sources, and supporting long-term ecological balance. Farmers adopt self-sufficient practices like seed preservation and composting, enhancing agricultural resilience.*

4.4.3 Reason behind the growth in family income through agroforestry

In recent days, people in Bethanchowk adapting agroforestry as a result of gradual income growth they realized. Even when people are unable to find any specific job nearby, they prefer to manage surrounding resources differently so that they can have access to good

income sources. People adapt agroforestry not just because of any single reason behind but rather people can add up different alternatives by which they can induce income. The actual response of the participants regarding the reason to growing income are shown in the table.

Table 4.27

Reason to increase family income in Bethanchowk

Basic reasons for Income growth	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
Animal husbandry with farming	198	55.6	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.27 highlights the basic reason behind the growth in income in the study area. Majority of the participants prefer to adapt agroforestry because they can integrate livestock with farming that facilitate multiple income source like; manure of fertilizer, means of cultivation (animal labour), milk and meat jointly. Similarly some of them believe that agroforestry facilitates regular annual income sources and also remarkable prospects of multiple cropping in a single plot of land. This indicates that integrated farming systems are central to livelihood sustainability, reflecting common rural practices in Nepal.

4.4.4 Agroforestry for maintaining food security

People perceived agroforestry as a favorable means of food security in Bethanchowk because mixture of both of the agriculture and forestry regenerate varieties fruits, crops and vegetable by which people can fulfill everyday needs in comfortable ways. Likewise, agroforestry encourage people to livestock and other intensive farming that also provides essential human nutrients like; eggs, meat and varieties of dairy products. That is why, agroforestry is considered as a good way to maintain food security in the study area. The actual perception of the participants are shown by the help of table 4.28.

Table 4.28*Arguments regarding agroforestry for food security*

Argument of respondents	Frequency	Percent	Cumulative Percent
Strongly disagree	4	1.1	1.1
Disagree	24	6.7	7.9
Neither agree nor disagree	65	18.3	26.1
Agree	200	56.2	82.3
Strongly agree	63	17.7	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.28 represents the agreement or disagreement of the participants regarding the role of agroforestry for food security. Nearly three-quarter of the participants are positive holding about 18 per cent strongly agreed means there is highly positive impact of agroforestry to food security. While, some 18.3 per cent have given neutral response reveals that some of them may be still uncertain about it. On the other hand, relatively small proportion of disagreement may suggest to make them aware and issue to be addressed. In this connection one of the key informant argued as below:

Participant 7: *Agroforestry improves food security through enhanced agricultural productivity and diversified income streams. Farmers use forest-based organic fertilizers, reducing input costs and ensuring food supply. Surplus products contributes to household income, enabling better living conditions.*

4.4.5 Agroforestry to reduce soil erosion and support biodiversity

Agroforestry plays critical role by reducing soil erosion and supporting biodiversity in most of the country through integrated land use practices. In one hand the deep root structure of the trees along with counter planting in edges and slopes prevent slides and soil runoff risks and its leaf litter improve productivity through moisture retention. On the other, planned agroforestry facilitates multispecies, genetic diversities and create habitat for birds, insects and small animals. More interestingly, it attracts pollinators like bees and butterflies crucially support for forest regeneration and productivity gain. That is how agroforestry ensures

environmental sustainability and livelihood support even participants actually can explain such benefits or not.

Table 4.29

Response regarding the role of agroforestry to reduce soil erosion & biodiversity

Argument of participants	Frequency	Percent	Cumulative Percent
Strongly disagree	5	1.4	1.4
Disagree	11	3.1	4.5
Neither agree nor disagree	40	11.2	15.7
Agree	224	62.9	78.7
Strongly agree	76	21.3	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.29 demonstrates strong overall support (84.2%) for the argument that agroforestry can reduce soil erosion and support biodiversity. There is only a small proportion of participants showing neutral and negative responses. This indicates a high level of consensus among people, suggesting that the issue enjoys broad acceptance or approval. In this regard, one of the key informants argued as follows:

***Participant 14:** Farmers use agroforestry to address both environmental and economic challenges. AF reduces soil erosion, protects farmland, and increases biodiversity. Economically, it provides income stability through multiple products such as crops, timber, and livestock.*

4.4.6 Agroforestry for environmental challenges like drought, flood and storm

Agroforestry formally helps to mitigate drought, floods and storm like environmental challenges by creating sustainable landscapes with integrated land use practices. It offers nature-based solution like improved water source management, erosion control and making natural protection mechanism against climate extremes. Such efforts seems more promising in vulnerable ecosystem like Nepal and more specifically to the flood-prone regions of Betanchowk. The perception are plotted in table 4.30.

Table 4.30

Agroforestry to reduce environmental extremes like; drought, floods and storms

Argument of respondents	Frequency	Percent	Cumulative Percent
Strongly disagree	8	2.2	2.2
Disagree	21	5.9	8.1
Neither agree nor disagree	112	31.5	39.6
Agree	144	40.4	80.1
Strongly agree	71	19.9	100.0
Total	356	100.0	

Source: Field survey, 2024

Since there is above 60 per cent agreement of the participants about the role of agroforestry to control over environmental extremes, still there is doubt in people may be due to the immediate past devastating landslides caused by the heavy rainfall of 27-28 September, 2024. A significant proportion of participants showing neutral stance suggesting the uncertainty to the people may possibly be due to limited understanding.

4.4.7 Reduction in farming production costs and dependencies outside

Livelihood sustainability can be ensured with the reduced cost of farm production through the independence in inputs required for them. People can maintain organic fertilizer for farming and minimize the needs of insecticides and pesticides through beneficial insects. Similarly, shading trees protects moisture of soil reduces irrigation expenses. The easy access of biofuels and firewood not only save forest but also the fuel expenses too. That is how agroforestry system create a self-sustaining environment by reducing dependencies on external inputs and ensure higher productivity for longer time. The actual response of participants are shown in table 4.31.

Table 4.31*Agroforestry to reduce farmer's dependencies and production costs*

Argument of respondents	Frequency	Percent	Cumulative Percent
Strongly disagree	6	1.7	1.7
Disagree	14	3.9	5.6
Neither agree nor disagree	81	22.8	28.4
Agree	184	51.7	80.1
Strongly agree	71	19.9	100.0
Total	356	100.0	

Source: Field survey, 2024

The majority of participants nearly two-third of them expressed agreement with the argument, indicating strong positive sentiment. A relatively small per cent (5.6%) disagreed means very few people are against the arguments while 22.8 per cent remained neutral, reflecting a generally favorable consensus with minimal opposition. However, there is a need of wider awareness about the strength of agroforestry to reduce dependency outside.

4.4.8 Agroforestry for soil fertility and water source retention

The scientific reason behind soil fertility features of agroforestry is that it facilitates nutrient cycling, nitrogen fixation, erosion control and supply organic matters as a result of integrated practices of trees, crops and livestock. Similarly, agroforestry supports to reducing surface runoff, groundwater recharge and acts as a buffer zone, prevent surface dryness and protect water quality. Realizing these unseen facts, people prefer protecting forest to safeguard their livelihood. The actual perception of the participants regarding this feature are shown in the table.

Table 4.32*Agroforestry as a means to protect soil fertility and water sources*

Argument of respondents	Frequency	Percent	Cumulative Percent
Strongly disagree	2	.6	.6
Disagree	7	2.0	2.5
Neither agree nor disagree	30	8.4	11.0
Agree	190	53.4	64.3
Strongly agree	127	35.7	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.32 summarizes participants' opinions on a protective role of agroforestry for soil fertility and water sources based on their level of agreement. The analysis reveals that a significant majority (89.1%) of respondents supported the argument, with minimal disagreement by only 2.5 per cent of them. A small neutral segment means still a small proportion of the people are not aware about the benefits of agroforestry. This strong positive response suggests a high level of acceptance of the argument presented.

4.4.9 Agroforestry to maintain long term ecological stability

Agroforestry maintains long-term ecological stability by creating a balanced and sustainable ecosystem. It works as a sustainable system by conserving biodiversity, improving soil and water management, mitigating climate change, and enhancing farm productivity. Its holistic approach creates an environmentally stable and economically viable system, ensuring long-term ecological stability. The following table 6.8 represents how the research participants perceived about the long term stability related service of agroforestry.

Table 4.33a*Agroforestry for long term ecological stability*

Argument of respondents	Frequency	Percent	Cumulative Percent
Disagree	13	3.7	3.7
Neither agree nor disagree	45	12.6	16.3
Agree	207	58.1	74.4
Strongly agree	91	25.6	100.0
Total	356	100.0	

Source: Field survey, 2024

The table 4.33a demonstrates a high level of agreement by nearly 84 per cent among participants, with minimal disagreement of less than 4 per cent and a moderate neutral segment of 12.6 per cent. This figure indicates that the argument was well-accepted by great majority, with highly significant positive sentiment and limited opposition. While analyzing the correlation between the knowledge about agroforestry and its potential impact on ecological stability following result are found:

Table 4.33b*Correlation between agroforestry knowledge and its role on long term eco.Stability*

		Knowledge about agroforestry	Agroforestry to maintain long term ecological stability
Knowledge about agroforestry	Pearson Correlation	1	.215**
	Sig. (2-tailed)		.000
	N	356	356
Agroforestry to maintain long term eco. stability	Pearson Correlation	.215**	1
	Sig. (2-tailed)	.000	
	N	356	356

** . Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation value of 0.215 indicates a positive correlation between the two variables. The positive correlation suggests that individuals with greater knowledge

about agroforestry are more likely to recognize its ecological benefits, such as promoting long-term environmental stability. Although the relationship is not very strong, it highlights the importance of enhancing agroforestry education and awareness to promote ecological sustainability practices.

4.4.10 Social contribution of agroforestry for knowledge and social empowerment

The social contribution of agroforestry toward knowledge development and social empowerment can be claimed through its role in fostering community learning, enhancing livelihoods, and promoting social equity. Agroforestry fosters knowledge development through skill sharing, enhancement, education, and research, while promoting social empowerment by improving livelihoods, ensuring gender equity, and building community resilience. Its participatory nature empowers farmers to become innovators and leaders, making agroforestry a powerful tool for social progress.

Table 4.34

Social contribution of agroforestry for knowledge sharing and empowerment

Argument of respondents	Frequency	Percent	Cumulative Percent
Strongly disagree	2	0.6	0.6
Disagree	6	1.7	2.2
Neutral	53	14.9	17.1
Agree	206	57.9	75.0
Strongly agree	89	25.0	100.0
Total	356	100.0	

Source: Field survey, 2024

Table 4.34 demonstrates the positive sentiments of majority of the participants where, about 60 per cent agreed and 25 per cent strongly agreed. A combined total of 82.9 per cent participants expressed positive sentiment indicates strong support for the argument, suggesting widespread approval. Some 14.9 per cent held neutral views represent a moderate indifference of the people, while only a small Percent of participants disagreed. This indicates strong overall support with minimal opposition and limited neutrality.

4.4.11 Common perception on agroforestry that ensure sustainable livelihood

Agroforestry is said to be a suitable strategy to strengthen better opportunities and lasting livelihood outcome that ensure rural livelihood sustainable. Considering the aforementioned economic, social and environmental importance, agroforestry can truly maintain sustainable livelihood in the study are. Table 4.35 demonstrate the overall response of the participants representing what people believed in.

Table 4.35

Common perception of agroforestry to ensure sustainable livelihood

Livelihood components	No of responses	Percent
Increased income	136	38.20
Contribute for food security	200	56.18
Reduce soil erosion	224	62.92
Reduce environmental risks	144	40.44
Reduced dependencies	184	51.68
Protect water sources	190	53.37
Ensure environmental stability	207	58.15
Boost Empowerment and knowledge share	206	57.86

Source: Field survey, 2024

As shown in table 4.35, except in the case of income and environmental risk reduction, more than half of the research participants argued agroforestry as a favorable strategy to maintain sustainable livelihood outcomes. They simply believe that as a result of combined efforts of human with economy and ecology agroforestry provides livelihood options that looks lasting the future. The idea of key informant 9 during field survey responded highlighting how agroforestry maintain sustainable livelihood is quoted below:

Participant 9: *Agroforestry forms the backbone of rural livelihoods by providing income, food security, and employment. Farmers benefit from improved crop yields, increased livestock productivity, and the availability of firewood and timber. The integration of farming components sustains livelihoods and enhances living standards for now and future as well which was difficult before.*

In a nutshell, Agroforestry in Bethanchowk has evolved from subsistence farming to a more commercial and systematic practice. Despite evident ecological and economic benefits, its full potential remains untapped due to policy gaps, limited market access, and insufficient local government support. Strengthening institutional frameworks and providing technical and market-oriented support can further enhance contribution of agroforestry to sustainable rural livelihoods in Nepal.

CHAPTER - V

SUMMARY OF THE FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Findings

The study area is located in a rural hill area of Kavrepalanchowk district which lies in Bagmati province of Nepal with the population of 22.66 thousand, predominantly living Tamang community followed by Brahmin, Chhetri with dalits in minority. The educational status of the people is linked with family size having higher literacy rate among medium-sized family. Out of total participants of this research, more than 76 per cent household engaged in agriculture and livestock among which 68 Percent considered it as primary source of household earning.

In agroforestry system, the research participants have preferred agrosilvopastoral and home-garden in which each of cropping, livestock and forest based output are combined. More than 36 per cent are keep on practicing agroforestry for more than 10 years where nearly one third don't know the exact timeline of agroforestry starting. Practicing agroforestry has found to be changed due to increased ecological consciousness of nearly half of the participants while key reason to adapting it is due to soil productivity enhancing feature and food security. Nearly one-fourth of the participants thought that agroforestry contribute household income by source diversification, food security, employment generation and improving land productivity.

Nearly two-third of the participants believe that basic benefit of agroforestry is the easy supply of firewood and timber which is essential for daily life whereas next 23.3 per cent believe it is good for reducing deforestation followed by biodiversity conservation.

Even agroforestry playing remarkable role, some 44 per cent of the participants didn't get any support whereas, others received fundamental support mainly from Palika office followed by few NGOs. Out of total, about 82 per cent of the participants reported that agroforestry builds economic and environmental resilience. Likewise, 86.5 per cent participants viewed agroforestry as a key to strengthen livelihood whereas nearly 73 per cent agreed that it mitigates soil erosion, landslides and floods. It has believed by three-quarter of the participants that agroforestry improve farm productivity with organic farming system. In case of responsibility to promote agroforestry, nearly 60 per cent believed self-responsibility whereas one-fourth of them thought to be local government's responsibility.

It is believed that agroforestry has been changing recent days due to environmental consciousness of common people along with community collaboration to cope with. Local bodies contributed significantly to farm productivity growth, though community-driven initiatives also played a vital role. It has suggested that the role of agroforestry can be enhanced through emphasizing the need for policy-driven support and greater community involvement. Livelihood sustainability are measured by the help of economic, social and environmental components of people in the study areas. As a result of agroforestry practices, 62 per cent of the participants are getting benefited with basic agriculture and rest 14.3 per cent with commercial agriculture because of sufficiency of farmland and forest resources. About 56 per cent of the participants securing growth in income because livestock with farming whereas nearly 30 per cent saw good prospect in annual income growth chain. Nearly three-quarter of the participants agreed that agroforestry supports Food security through crop diversification and livestock products. More than 84 per cent of them agreed agroforestry reduces soil erosion and supports biodiversity. About 60 per cent of them agreed that agroforestry can mitigate drought, floods and storms despite their prior landslides experiences. Nearly 90 per cent of them believe that agroforestry enhances soil fertility and conserve water sources. Out of total, about 83.7 per cent of the participant agreed that agroforestry promotes long-term ecological stability the ensure livelihood sustainability. Last but not the list, 82.9 per cent of them recognized the role of agroforestry in fostering knowledge, promoting equity and strengthening community resilience that ensure social wellbeing and sustainability.

5.2 Conclusion

This study highlights the vital role of agroforestry in fostering sustainable livelihoods in the rural hill areas of Nepal. With a socio-economic structure deeply tied to agricultural and forestry-based activities, agroforestry emerges as a critical strategy for enhancing economic resilience, environmental sustainability, and social development aligning closely with global sustainable development goals. The preferred agroforestry models are agrosilvopastoral systems and home gardens that support income diversification, food security, and ecological conservation.

Participants emphasized agroforestry's contributions to soil fertility, water conservation, and disaster mitigation, while also recognizing its potential for long-term ecological stability. Despite its benefits, limited external support suggests the need for

stronger policy-driven initiatives and enhanced community engagement. Agroforestry thus stands out as a sustainable strategy for rural development, offering lasting socio-economic and environmental benefits. The study highlights the transformative potential of agroforestry in transitioning rural economies from subsistence farming to diversified, resilient systems. By integrating local practices with scientific innovations, agroforestry offers a vigorous pathway for addressing rural poverty, environmental degradation, and climate vulnerabilities. This research emphasizes the necessity of multi-stakeholder collaboration to promote agroforestry as a cornerstone of sustainable rural development in Nepal.

5.3 Recommendations

5.3.1 General recommendations:

-) It is necessary to promote community participation in agroforestry projects so that the responsibilities and participatory resource management can ensure.
-) Collaboration should be encouraged through farmer cooperatives to common resources, negotiate better prices, and access larger markets linkage.
-) Specialized training should be provided to farmers and extension workers that enhance skills and productivity in agroforestry.
-) Specific focus on developing improved crop varieties, new agroforestry models, and innovative farming techniques to meet with local conditions.
-) Access to technical expertise and funding should be ensured to strengthen agroforestry initiatives in community level.

5.3.2 Policy recommendations:

-) Establishment of well-defined policies is essential that position agroforestry as a key component of local and national development plans, ensuring long-term sustainability.
-) Designing policies that integrate agroforestry into national frameworks, emphasizing environmental conservation and rural livelihood enhancement.
-) Offering financial incentives to farmers by the authority to reduce the cost burden could be better instrument to encourage wider adoption of agroforestry practices.

-) Dedicated market hubs would be better tool to enhance market access for agroforestry products and reduce transportation challenges.

5.3.3 Knowledge contribution:

-) This research has develop new agroforestry models that can cope with diverse ecological and socioeconomic conditions.
-) The document can be used to conduct workshops and training programs to disseminate innovative and sustainable agroforestry practices.
-) This research is helpful to strengthen collaborative efforts among stakeholders to evolve agroforestry into a robust model for sustainable rural development, benefiting the environment, economy, and society.

5.3.4 Areas for further research:

This research has tried to establish the contribution of agroforestry in making livelihood sustainable so that people should not compromise the livelihood options in the future in the given circumstances of the study area. However, there are many areas to be explored and established by further researchers that are pointed as follows:

-) Explore the potential of agroforestry in enhancing rural livelihoods under various ecological conditions.
-) Study the impact of financial incentives on the adoption rate of agroforestry practices.
-) Investigate innovative agroforestry systems and their adaptability to local climate and soil conditions.
-) Assess the role of market hubs in reducing barriers to agroforestry product commercialization.
-) Analyze the long-term effects of agroforestry policies on environmental conservation and rural development.

REFERENCES

- Adam, A. M. (2020). Sample size determination in survey research. *Journal of scientific research & report*.25 (5): 90-97. <https://DOI:10.9734/JSRR/2020/v26i530263>
- Adhikari, S., Ghimire, S. & Paneru, S. (2018). Resilience in agricultural productivity through agroforestry: Possible contribution to food security in Nepal. *Journal of Pharmacology and Phytochemistry*. 2138-2141. www.phytojournal.com
- Arnold, J. E. M. (1987). Economic considerations in agroforestry. In P.K. Steppeler and P. K. R. Nair (Eds.), *Agroforestry: A decade of development*, 173-190. <https://shorturl.at/XeTTK>
- Atangana, A., Khasa, D., Chang, S., Degrande, A., Atangana, A., Khasa, D., ... & Degrande, A. (2014). Socio-cultural aspects of agroforestry and adoption. *Tropical agroforestry*, 323-332. https://doi.org/10.1007/978-94-007-7723-1_17
- Bansal, V., Joshi, V., & Meena, S. C. (2021). Agroforestry for sustainable rural livelihood: A Review. *Turkish Online Journal of Qualitative Inquiry*, 12(10). <https://www.researchgate.net/publication/356790149>
- Bennett, N. (2010). Sustainable livelihoods from to conservation practice: An extended annotated bibliography for prospective application of livelihoods thinking in protected area community research. *Protected Area and Poverty Reduction Alliance Working Paper No. 1*. <https://shorturl.at/JFQnN>
- Bethanchowk Gaunpalika. (2076BS). Bethanchowk Gaunpalikako Ghardhuri Servekshan Tatha Thayanka Byabasthapan [Households survey and Statistical Management of Bethanchowk Rural Municipality]. Bethanchowk Gaunpalika.
- Black, D. (2017 March 28). Agroecology - the who's who. *Blue North: Thinking Future*. <https://bluenorth.co.za/agroecology-the-whos-who/>
- Borelli, S., Simelton, E., Aggarwal, S., Olivier, A., Conigliaro, M., Hillbrand, A., ... & Desmyttere, H. (2019). Agroforestry and tenure. *Food and Agriculture*

Organization of The United Nations, International Centre for Research in Agroforestry, 8.

- Brown, S. E., Miller, D. C., Ordonez, P. J., & Baylis, K. (2018). Evidence for the impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in high-income countries: a systematic map protocol. *Environmental evidence*, 7, 1-16. <https://doi.org/10.1186/s13750-018-0136-0>
- Central Bureau of Statistics. (2012). *National population and housing census (National Report)*. Government of Nepal.
- Central Bureau of Statistics. (2022). *National Sample Census of Agriculture 2021/2022*. CBS, Government of Nepal. <https://agricensusnepal.gov.np>
- Chronology of National Agroforestry Policy Development in Nepal 2014-2019 AD (2071-2076 BS). (2019). <https://shorturl.at/RHbq4>
- Creswell, J. W. & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed method approaches* (5th Ed.). SAGE Publication Inc.
- Creswell, J. W. & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed method approaches* (6th Ed.). SAGE Publication Inc.
- Dagar, J. C., & Tewari, V. P. (2017). Evolution of agroforestry as a modern science. *Agroforestry: Anecdotal to modern science*, 13-90. https://doi.org/10.1007/978-981-10-7650-3_2
- Dhakal, A., Cockfield, G. & Maraseni, T.N. (2012). Evolution of agroforestry based farming systems: a study of Dhanusha District, Nepal. *Agroforest Syst* 86, 17–33. <https://doi.org/10.1007/s10457-012-9504-x>
- 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

- Division Ban Karyalaya (2080BS). *Samudayik tatha Kabuliyet Ban Samuhaharuko Anugaman tatha Mulyankan Pustika [Monitoring and Evaluation Book of Community and Leasehold Forest Users Groups]*. Divisin Ban Karyalaya 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>
- Elbakidze, M., Surova, D., Munoz-Rojas, J., Persson, J-O., Dawson, L., Plieninger, T. and Pinto-Correia, T. (2021). Perceived benefits form agroforestry landscapes across North-Eastern Europe: What matters and for whom? *Journal of Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2021.104044>
- FAO & ICRAF. (2019). *Agroforestry and tenure*. Forest working paper no. 8. Rome. (p. 40). Food and Agricultural Organization of the United Nations and International Centre for Research in Agroforestry. www.fao.org/publications
- Forest Research and Training Centre. (2020). *Policy Brief on Development of Agroforestry Systems in Nepal*. <https://shorturl.at/rBq8Q>
- Gangadharappa, N. R., Shivamurthy, M., & Ganesamoorthi, S. (2003, September). Agroforestry–A viable alternative for social, economic and ecological sustainability. In *XII World Agroforestry Congress*.
- 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/>

- Jha, L. K., & Sarma, P. K. (2009). *Agroforestry-Indian Perspective*. APH publishing.
- Karki, M. (2019). Bethanchowk Rural Municipality Profile, Facts and Statistics.
<https://shorturl.at/fFE2t>
- Kathmandu declaration on agroforestry (2015 March 28). <https://shorturl.at/yDtRa>
- 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>
- Kiptot, E., Franzel, S., & Degrande, A. (2014). Gender, agroforestry and food security in Africa. *Current opinion in environmental sustainability*, 6, 104-109.
<https://doi.org/10.1016/j.cosust.2013.10.019>
- Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & quantity*, 43, 265-275. <https://doi.org/10.1007/s11135-007-9105-3>
- Longpichai, O. (2012). Concept of sustainable agriculture and its link to agroforestry system. *Department of agricultural economics, Faculty of economics, Prince Songkhla University, Songkhla, 9012*. <https://shorturl.at/d1UrO>
- Mahmud, A., Kpamor, V. & Grayson T, (2014), Agroforestry theories and practices in sustainable land use system in Nigeria. *International Journal of Agroforestry and Silviculture Vol. 1 (5)*, 52-054
- Mbow, C., Van Noordwijk, M., Luedeling, E., Neufeldt, H., Minang, P. A., & Kowero, G. (2014). Agroforestry solutions to address food security and climate change challenges in Africa. *Current Opinion in Environmental Sustainability*, 6, 61-67.
<https://doi.org/10.1016/j.cosust.2013.10.014>
- Mbow, C., Van Noordwijk, M., Prabhu, R., & Simons, T. (2014). Knowledge gaps and research needs concerning agroforestry's contribution to sustainable development goals in Africa. *Current Opinion in Environmental Sustainability*, 6, 162-170.

- Mercer, D. E., Frey, G. E., & Cubbage, F. W. (2014). Economics of agroforestry. In *Handbook of Forest Resource Economics* (pp. 204-225). Rutledge.
<https://shorturl.at/9V5hq>
- Miller, D. C., Ordonez, P. J., Brown, S. E., Forrest, S., Nava, J. J., Hughes, K. and 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 Systemic Review*, 16 (1).
<https://shorturl.at/1us0F>
- Ministry of Agriculture and Livestock Development. (2019). *National Agroforestry Policy 2019*. Governemnt of Nepal. <https://shorturl.at/o7RAp>
- Ministry of Finance (2020). *Economic Survey 2019/20*. Government of Nepal.
- Ministry of Forest and Soil Conservation (1988). *Master Plan for the Forestry Sector Nepal Impact and Monitoring Plan*. <https://shorturl.at/EVCR8>
- Ministry of Forest and Soil Conservation. (2000). *Forestry Sector Policy of Nepal 2000*. <https://shorturl.at/WnWs8>
- Ministry of Forest and Soil Conservation. (2016). *Forestry Sector Strategy (2015- 2025)*. Government of Nepal. <https://shorturl.at/T1Hwj>
- Molua, E. L. (2005). The economics of tropical agroforestry systems: the case of agroforestry farms in Cameroon. *Forest Policy and Economics*, 7(2), 199-211.
[https://doi.org/10.1016/S1389-9341\(03\)00032-7](https://doi.org/10.1016/S1389-9341(03)00032-7)
- Morse, S. & McNamara, N. (2013). Sustainability and Sustainable Livelihoods. In: Sustainable Livelihood Approach. Springer. https://doi.org/10.1007/978-94-007-6268-8_1
- Morse, S., & McNamara, N. (2013). *Sustainable livelihood approach: A critique of theory and practice*. Springer Science & Business Media.
<https://doi.org/10.1007/978-94-007-6268-8>
- Municipal Profile. (2080BS). An unpublished compiled record of Bethanchowk Rural Municipality. Municipal office of Bethanchowk.

- Nair, P. R. (2011). Agroforestry systems and environmental quality: introduction. *Journal of Environmental Quality*, 40(3), 784-790. <https://doi.org/10.2134/jeq2011.0076>
- Natarajan, N., Newsham, A., Rigg, J., & Suhardiman, D. (2022). A sustainable livelihoods framework for the 21st century. *World Development*, 155, 105898. <https://doi.org/10.1016/j.worlddev.2022.105898>
- National Planning Commission. (2024). *The Sixteenth Plan (Fiscal Year 2024/25 - 2028/29)*. Government of Nepal. <https://shorturl.at/LMdMS>
- Neupane, R. P., Sharma, K. R., & Thapa, G. B. (2002). Adoption of agroforestry in the hills of Nepal: a logistic regression analysis. *Agricultural systems*, 72(3), 177-196. [https://doi.org/10.1016/S0308-521X\(01\)00066-X](https://doi.org/10.1016/S0308-521X(01)00066-X)
- Ogunsiji, A. O., Ibrahim, T. O., & Oni, O. A. (2020). Impacts of agroforestry in agricultural sustainability and food security in Nigeria. *Asian Research Journal of Agriculture*, 43-50. <https://shorturl.at/WcgoZ>
- Ollinaho, O. I., & Kröger, M. (2021). Agroforestry transitions: The good, the bad and the ugly. *Journal of Rural Studies*, 82, 210-221. <https://shorturl.at/gv2OV>
- Onwuegbuzie, A. J., Jiao, Q. G., & Collins, K. M. (2007). Mixed methods research, a new direction for the study of stress and coping. In G. S. Gates (Ed.) *Emerging Thought and Research on Student, Teacher, and Administrator Stress and Coping* (pp.211-240). Information Age Publishing, Inc. <https://shorturl.at/lvoP7>
- Ostrom, E. (2002). Common-pool resources and institutions: Toward a revised theory. *Handbook of agricultural economics*, 2, 1315-1339. [https://doi.org/10.1016/S1574-0072\(02\)10006-5](https://doi.org/10.1016/S1574-0072(02)10006-5)
- Pandit, B. H., Nuberg, I., Shrestha, K. K., Cedamon, E., Amatya, S. M., Dhakal, B., & Neupane, R. P. (2019). Impacts of market-oriented agroforestry on farm income and food security: insights from Kavre and Lamjung districts of Nepal. *Agroforestry Systems*, 93, 1593-1604. <https://doi.org/10.1007/s10457-018-0273-z>

- Pandit, B. H., Shrestha, K. K., & Bhattarai, S. S. (2014). Sustainable local livelihoods through enhancing agroforestry system in Nepal. *Journal of Forest and Livelihood* 12 (1) 47-63. <https://www.nepjol.info/index.php/JFL/article/view/65680>
- 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>
- Plieninger, T., Muñoz-Rojas, J., Buck, L. E., & Scherr, S. J. (2020). Agroforestry for sustainable landscape management. *Sustainability Science*, 15(5), 1255-1266. <https://doi.org/10.1007/s11625-020-00836-4>
- Quandt, A., Neufeldt, H., & McCabe, J. T. (2019). Building livelihood resilience: what role does agroforestry play? *Climate and Development*, 11(6), 485-500. <https://doi.org/10.1080/17565529.2018.1447903>
- Raihan, A. (2024). The potential of agroforestry in South Asian countries towards achieving the climate goals. *Asian Journal of Forestry*, 8(1). <https://doi.org/10.13057/asianjfor/r080101>
- Raj, A. J., & Lal, S. B. (2014). *Agroforestry Theory and Practices*. Scientific publishers.

- 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). <https://shorturl.at/Vt7Xs>
- Sahoo, G. & Wani, A. M. (2020). Agroforestry in food security. Recent research in agriculture for doubling of farmer's income, 73-78. <https://shorturl.at/ZUOBn>
- Serrat, O. (2008 November). The Sustainable livelihood approach. Knowledge Solutions. <https://shorturl.at/5qQJ7>
- Sollen-Norrlin, M., Ghaley, B. B., & Rintoul, N. L. J. (2020). Agroforestry benefits and challenges for adoption in Europe and beyond. *Sustainability*, 12(17), 7001. <https://doi.org/10.3390/su12177001>
- Thakur, U. C. (2016 June). *SAARC Resolution on Agroforestry, 2016*. [Inception Meeting to Develop SAARC Regional Coordinated Program on Agroforestry]. Government of Nepal. <https://shorturl.at/kSEuW>
- Timalsina, T. R. (2019). Agricultural transformation around Koshi hill region: A rural development perspective. *NUTA Journal* 6 (1 & 2), 95-101. <https://doi.org/10.3126/nutaj.v6i1-2.23234>
- Tiwari, K. R., Bajracharya, R. M., Raut, N., & Sitaula, B. K. (2017). Agroforestry system: an opportunity for carbon sequestration and climate change adaptation in the mid-hills of Nepal. *Octa Journal of Environmental Research*, 5(1), 22-31. <http://www.sciencebeingjournal.com>
- Tiwari, P., Kumar, R., Thakur, L & Salve, A. (2017). Agroforestry for sustainable rural livelihood: A review. *International Journal of Pure and Applied Bioscience*, 5 (1), 299-309. <http://dx.doi.org/10.18782/2320-7051.2439>
- Todaro, M. P., & Smith, S. C. (2003). *Economic development*. Pearson Education.
- 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>

United Nations Development Program [UNDP]. (2017). *Guidance Note Application of the Sustainable Livelihoods Framework in Development Projects*. UNDP.
<https://shorturl.at/EWKS3>

Van Noordwijk, M., Coe, R. & Sinclair, F. (2016). Central hypotheses for the third agroforestry paradigm within a common definition [Working paper 233]. World Agroforestry Centre (ICRAF) Southeast Asia Regional Program.
<http://dx.doi.org/10.5716/WP16079.PDF>

A. Nature and Trend of Agroforestry Practices

7) How much you know about agroforestry?

- 1) Perfectly unknown, 2) Unknown, 3) Neutral,
4) Known, 5) Perfectly known

8) How did you know by agroforestry?

- 1) From parents 2) From society 3) Self-practice
4) Informed by officials 5) Others

9) How long have you been practicing agroforestry?

- 1) A few years 2) 5-10 years 3) Above 10 4) No idea

10) What types of agroforestry practices do you implement?

- 1) Agro-siviculture 2) Agro-silvi-pastoral 3) Silvo-pasture
4) Home Garden 5) Others

11) What types of trees with crops do you grow in your agroforestry system?

- 1) Timber Trees 2) Fruit Tree 3) Multipurpose Trees
4) Shade Trees 5) Forage trees

12) How has the practice of agroforestry changed over the years?

- 1) Technological change 2) Increased environmental consciousness
3) Community collaboration 4) Youth involvement 5) Others

13) What are the main reasons for adopting agroforestry by your family?

- 1) Improve soil health; 2) Enhance biodiversity 3) Food security and income
4) Stable climate 5) No idea

B. Contribution of Agroforestry to Livelihood Sustainability

14) How does agroforestry contribute to your household income?

- 1) Income diversified 2) Food security 3) Increased Employment
4) Increase land productivity 5) Reduced production cost

15) What other benefits do you obtain from agroforestry?

- 1) Easy for fuel wood & timber 2) Reduction in Deforestation
3) Protection of culture & tradition 4) Social integration-
5) Increased biodiversity

16) Do you receive any technical or financial support for practicing agroforestry? If yes, from whom?

- 1) Agricultural office 2) Forest office 3) NGO/INGOs 4) Local Palika 5) Others

	Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
17	Are you agree that agroforestry improved your resilience to economic or environmental shocks?					
18	Are you agree that agroforestry can maintain livelihood sustainability in this region?					
19	Do you think agroforestry practices, can protect your farm from soil erosion, flooding, or landslides?					
20	Are you agree that agroforestry can improve your farm productivity?					
21	Who should be more responsible to promote agroforestry to escape from varieties of vulnerabilities?	Self	Community	NGO/INGOs	Local Bodies	Central Government

C. Strength of agroforestry to ensure livelihood sustainability

22) Why do you think that agroforestry is appropriate for livelihood sustainability in your region?

1) Enough farmland 2) Sufficiency of forest 3) Being best strategy 4) No other strategy

23) At what per cent do you think your income increased after adapting modern agroforestry?

1) No idea 2) Less than 25 % 3) 25-50% 4) 50-75% 5) Above 75%

	Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
24	Do you agree with the view that agroforestry reduces food shortages through diversified products?					
25	Do you agree with the argument that agroforestry reduce soil erosion and support biodiversity?					
26	Do you agree that agroforestry reduces environmental extremes like; drought, floods and storms?					
27	Do you agree that agroforestry can reduces farmer's dependencies and production costs?					
28	Does agroforestry practices contribute to soil fertility and water retention?					
29	Do you agree with the argument that agroforestry maintain long term ecological stability?					
30	Can agroforestry practice contribute for knowledge sharing and community empowerment?					

Finally, what can be done for the renovation of existing agroforestry so that it can help for faster recovery from such disaster (massive flood and landslide) which was happened few time back?

.....
.....
.....
.....

Thank you for your kind information. Your information will not misused and no harmful use to anybody else.

APPENDIX-2

Checklist for key informant interview

Name:

Position/Role:

Organization/Institution:

Location:

- i. Can you describe the common agroforestry practices in this area& change over time?
- ii. What are the primary motivations for farmers to adopt agroforestry in this region?
- iii. In your opinion, how does agroforestry contribute to the livelihoods of rural households?
- iv. Can you explain how agroforestry has improved food security or income for local communities?
- v. How does agroforestry help communities cope with environmental or economic challenges?
- vi. How do agroforestry practices contribute to sustainable agricultural practices in this area?
- vii. What impact does agroforestry have on forest conservation efforts?
- viii. What challenges or limitations do farmers face in implementing agroforestry?
- ix. How do local governance support or hinder agroforestry efforts?
- x. What policies or programs support agroforestry practices in this region?
- xi. What could be the measure of effectiveness of agroforestry practices?
- xii. If you have anything to tell about the current crisis to escape from?

Annex - I
Supporting photos from field visit



Capture -1: Researcher with an Engineer of Bethanchowk in front of Municipal office



Capture -2: Research at Ward no 2 during data collection, background scene of neighboring Gaunpalika



Capture -3:Photo capture by researcher while research assistant requesting for time to interview, ward-5



Capture -4: A perfect scenery of agroforestry practice at ward no 3



Capture -5: Researcher with research assistant at Ward no 6



Capture -6: A good practice of agroforestry taken by researcher at ward no 4



Capture -7: The entry gate of Bethanchowk after pitched road destroyed by flood



Capture -8: A perfect scenery of solid mixture of agriculture and forestry at Bethanchowk