

Action Research on Ecosystems and Ecosystem Services Management in Udayapur, Nepal: A Documentation of Process and Learning



About ICIMOD

The International Centre for Integrated Mountain Development (ICIMOD), is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush Himalaya – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.



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Action Research on Ecosystems and Ecosystem Services Management in Udayapur, Nepal: A Documentation of Process and Learning

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Contents

Organisations Involved in the Action Learning	v
Foreword	vi
Acknowledgements	vii
Acronyms and Abbreviations	viii
Executive Summary	ix
1. Introduction	1
1.1 Background	1
1.2 Scope of Work	2
2. Action Research in the Face of Climate Change	3
2.1 Action Research	3
2.2 Action Learning in the Face of Climate Change	3
3. Methodology and Conceptual Framework of the Study	4
4. Processes Adopted in Action Research	5
4.1 Step I: Action Learning Conceptualisation and Design	6
4.1.1 Relevance of the research	6
4.1.2 Research methodology	6
4.1.3 Research time frame and iterative process	7
4.2 Step II: Preparing for the Research – Selection of Sites and Partners	7
4.2.1 Selection of district and VDC	7
4.2.2 Selection of partners at the national level	8
4.2.3 Selection of a partner at the district level	8
4.2.4 Identification of the roles of stakeholders	8
4.3 Step III: Diagnosis of the Local Context and Identification of Research Action	9
4.3.1 Reconnaissance visits	9
4.3.2 Inception workshop	9
4.3.3 Meeting with District Forests Office (DFO)	10
4.3.4 Discussions with CFUGs and selection of a CFUG for the research	10
4.3.5 Consultation meeting with users members within the selected CFUGs	10
4.3.6 Selection of technologies for piloting	10
4.3.7 Preparation of concept note on the action research and detailed implementation plan	11
4.4 Step IV: Facilitating the Capacity Building Process	12
4.4.1 Exposure visits	13
4.4.2 Trainings	14
4.4.3 Issue based interactions with experts	15
4.5 Step V: Implementing the Piloting Interventions	16
4.5.1 Baseline creation	16
4.5.2 Planning	17
4.5.3 Implementing the planned actions	18
4.5.4 Collaborating with relevant stakeholders	19
4.6 Step VI: Monitoring, Evaluation and Learning and Documentation of Learning	20
4.6.1 Monitoring, evaluation and learning	20
4.6.2 Documentation of evidences and learning	22
5. Major Learnings and Areas for Improvement	23
5.1 Major Learnings	23
5.2 Main Driving Factors for Positive Change	24
5.3 Areas for Improvement	24
References	26

List of Maps, Boxes, Tables, Figures, and Photos

Map 1: Map showing the research sites	2
Map 2: Aerial map of location of activities implemented	18
Box 1: Local Participation was considered as important vehicle for collaborative research	12
Box 2: Voices from the second exposure visit	14
Box 3: A woman member from DAWCFUG is receiving a national award	16
Box 4: Action Research Protocol	17
Box 5: Joint monitoring visit	20
Box 6: local level joint monitoring process and achievement	21
Table 1: Major lessons from the action learning	23
Figure 1: Conceptual framework of the study	4
Figure 2: Major steps adopted during the action research implementation	5
Figure 3: Major steps, processes, and areas to be strengthened in the future	25
Photo 1: Village resource map	10
Photo 2: Technology transfer during exposure visit	13
Photo 3: Participatory context analysis	15
Photo 4: Leaf litter collection for weighing	17

Organisations Involved in the Action Learning

ICIMOD

ICIMOD is a regional knowledge development and learning centre addressing mountain issues and people, serving eight member countries of the HKH region. It has its base in Kathmandu, ensuring regional ownership. ICIMOD activities include: reducing scientific uncertainty, knowledge synthesis and management, developing regional databases, studies on climate change adaptation, capacity building, supporting for developing mountain policies, enhancing livelihoods, ecosystem services, awareness campaigns, and social inclusion, global and regional dialogue.

Working with people locally is critical to effective, sustainable, equitable conservation. One of the ICIMOD's most distinctive approaches has been to support the emergence and strengthening of networks of individuals and organisations at the site or community level. With BCN's knowledge on ecosystem services and livelihood benefit ICIMOD has built partnership with BCN in implementing this research. BCN will implement the research at the site with support of the local. This research will mainly assess the ecosystem services at the site and conduct action research on climate change adaptation.

Bird Conservation Nepal (BCN)

Established in 1982, BCN is the leading organisation in Nepal to focus on the conservation of birds, their habitats and sites. It is the foremost scientific authority providing accurate data and information on birds and their habitats throughout Nepal. BCN is a membership-based organisation. BCN is also part of the Birdlife International Partnership, a network of 120 organisations around the world, working on a worldwide agenda to conserve the world's birds and their habitats. Besides these, BCN has also been working on ecosystem services perspectives in the country. It has implemented Darwin Initiative's research "Understanding, Assessing and Monitoring of ecosystem services for better biodiversity conservation" in three Important Bird and Biodiversity Areas (IBAs) namely Shivapuri National Park(NP), Koshi Tappu Wildlife Reserve and Rara NP with the support of Birdlife International. The main objective of the programme was to build the capacity of BCN and Birdlife Partners in other Asian countries to collect and use information on ecosystem services for better biodiversity conservation. The programme was held from April 2010to March 2013. Recognising BCN's interest and knowledge in ecosystem services, it has been selected as a national level implementing partner institution for this research.

Nawaprabhat Nepal

Nawaprabhat Nepal was registered as not for profit organisation on October 1, 1995 with an objective to support governmental development policies and actions. It is based at Gaighat, Udayapur District. It has been involved on activities on disaster risk reduction, education research s, awareness campaigns, and health and sanitation research. Nawaprabhat Nepal is the local implementing partner for action research of ecosystem services management in this research.

Foreword

The Hindu Kush Himalaya (HKH) region forms one of the most fragile mountain chains of the world. The region is endowed with extremely rich biodiversity, diverse ecosystems, and habitats shared by millions of people. In recent years, new economic growth, shifting population dynamics, and climate change have taken place so intensely and rapidly that the established adaptation mechanisms of the people of the HKH are losing their efficacy. The result has been an increased risk of living in poverty and further marginalisation for mountain populations.

Rural Livelihoods and Climate Change Adaptation in the Himalayas (Himalica) is a demand-driven programme financed by the European Union and managed by ICIMOD. It aims to support vulnerable mountain communities in the HKH region to adapt to climate and socio-economic changes. The Himalica programme is being implemented through five main areas of activity: Building the capacity to formulate adapted policy, expanding knowledge management, strengthening collaborative action research, piloting activities for climate change adaptation, and capacity building.

Under the main areas of work ‘strengthening collaborative action research’, ‘Ecosystem management’ is one of the action research programme implemented by Bird Conservation Nepal (BCN) and Nabaprabhat Nepal (NP Nepal) in Rauta VDC of Udaipur district. The duration of the action research was three years (2014-2016). The overall objective of the programme was to conduct an action research in identified areas and show visible impact on the ground with socio-economic and ecosystem health as prime indicators. The collaborative action research on ecosystem management was anticipated to find proven solutions for improved ecosystem management on various ecosystem-based, alternative livelihood options as a major output. This action research has gone through a participatory process from planning, designing, implementation, supervision, and monitoring. In this regard, there are various learnings in each stages that ICIMOD would like to document systematically.

This publication is intended to document the full process of collaborative action research on ecosystem management implemented in Rauta VDC of Udaypur district of Nepal with the aim of comprehensively documenting the ‘process’ and the ‘lessons learnt’ from the action research that can contribute to the formulation of an ‘action plan’ for its policy/practice uptake beyond the project cycle. The process documentation, among other things, has given special emphasis on identifying factors that prompted changes in the study area based on the action research interventions, key actors, their roles and contributions, step by step process during the research, transition phases of changes, and stakeholders’ perspectives before and after the collaborative action research. We hope the document also serve as the benchmark for designing and implementing any participatory action research programme in the future. This document could be a very good reference for researchers, development workers, NGOs, academic institutions, and government line departments for planning and designing participatory action research intervention on the ground.

David Molden, PhD
Director General

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We are very thankful to community members including from *Dumrithumka Adarsha Women CFUG* for providing their time and invaluable information during the review process. We appreciate without their support this study would not have been possible.

We would like to sincerely thank Mr Sanjan Thapa and Ms Ishana Thapa from BCN, Mr Durga Nanda Chaudhari and Mr Karna Sonam from Nawaprabhat Nepal, Udayapur for their invaluable insights and constant support during the study. We would also like to extend our gratitude to the office heads and other staff from District Forests Office, District Agriculture Development Office and District Soil Conservation Office of Udaypur district for their time, information and constructive ideas.

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We would also like to thank Prof Wu Ning for his valuable review and suggestions to strengthen the publication. Warm appreciation goes to the editorial team of Christopher Butler, Dharma Maharjan for bringing the manuscript to its present form. We are also grateful to Diwas Raja for the editorial support. The findings, interpretations and conclusions expressed in this work are those of the authors only and do not necessarily reflect the views of ICIMOD and BCN.

Acronyms and Abbreviations

BCN	Bird Conservation Nepal
CFUG	Community Forests Users Group
DADO	District Agriculture Development Office
DAWCFUG	<i>Dumrithumka Aadharsha Women Community Forests Users Group</i>
DFO	District Forests Office
DLSO	District Livestock Service Office
DSCO	District Soil Conservation Office
EBP	Evidence Based Practice
ESA	Ecosystem Services Assessment
FECOFUN	Federation of Community Forests Users Nepal
FGDs	Focus Group Discussions
Himalica	Rural Livelihoods and Climate Change Adaptation in the Himalayas (Himalica)
HKH	Hindu Kush Himalaya
ICIMOD	International Centre for Integrated Mountain Development
ICS	Improved Cook Stove
KII	Key Informant Interview
MEL	Monitoring Evaluation and Learning
NGO	Non-Governmental Organisation
NTFPs	Non Timber Forests Products
PRA	Participatory Rural Appraisal
VDC	Village Development Committee

Executive Summary

Healthy ecosystems are intrinsically linked to our well-being and our quality of life. But native ecosystems are being impacted every day by both our actions and inactions in the face of increasing environmental and socio-economic challenges. It is therefore important to understand the socio-ecological system and promote ecosystems-based approaches by developing innovative strategies and tools to ensure integrity of the ecosystem and people's livelihoods. Considering the importance of balancing conservation and development with place based action research, ICIMOD supported an initiative, in collaboration with BCN and Nawaprabhat Nepal in Rauta VDC of Udayapur district Nepal, whose objective was 'to identify the practical solutions for improved ecosystem management through conducting collaborative action research on alternative livelihood options to show visible impact at the ground considering socio-economic and ecosystem health as indicators'. After two and half years of research implementation, ICIMOD initiated a study for process documentation to understand the enabling conditions for effective research execution and find out the effect of short-term action research. This process documentation mainly followed a participatory inquiry approach. The documentation team met various officials from ICIMOD, BCN, and Nawaprabhat Nepal to understand the research background, context, objectives and processes adopted by the action research. Some consultations with the local community were also carried out at research sites and government officials of the selected line agencies were also consulted in April/May 2016.

The research followed a distinctive process of action research, i.e., plan, action, observation, reflection, and improvement during its cycle. Within these broader phases, the research added some further activities with local needs and priorities in mind. In general, the complete set of processes of this action research can be grouped as: i) conceptualisation and design, ii) preparation, iii) diagnosis of the local context and identification of activities, iv) capacity building of the communities and stakeholders, v) implementing the piloting intervention, and vi) monitoring and documentation of evidences. The detail processes followed in each steps are briefly described below.

The research design is considered a very important stage of the action research as it generally guides and provides a roadmap to ensure the methodological rigour and quality of outputs of the action research. In this case, the high level objective of this research was determined during the Himalica programme formulation stage, but the specific objectives were designed based on evolving global discourse on ecosystem services and considering place-based socio-ecological system planning. There were further discussions carried out with partners to integrate local context while preparing the detail operational plan of the research. The research design proposed a sound and plausible research methodology to acquire reliable data and achieve the research objectives. The research has used a collaborative research approach with quasi-experimental and participatory research methods for the research and has collected both qualitative and quantitative data.

In the second step, the research used vulnerability assessment and socio-economic criteria to select the research sites. The main site selection criteria included: observed extreme climate events (past and present), assessment forests ecosystems, community interest, prior experience of implementing agencies, and accessibility of the research site. The research had national and local partners to manage the research effectively. These partners were selected in a transparent way through some pre-agreed technical criteria. The national level partners were selected based on their experience on contemporary ecosystems management and climate change issues at the national level, whereas local partners were selected based on their understanding of local contexts, credible rapport with local communities, and ability to manage district level stakeholders.

In the third step, the research carried out an in-depth diagnosis of the local context and identified key research activities. For this, the research used participatory inquiry methods (i.e., reconnaissance visits, inception workshop, as well as interaction with district level line agencies, CFUGs, and community members) to understand community needs. The participatory process also helped the communities to recognise the interdependence of ecosystems and livelihoods. Based on the interactions with communities, the research selected four technologies that promote ecosystems-based management for piloting. They were: i) zero grazing plot for degraded forest regrowth ii) reforestation of soil erosion areas, iii) home gardens, and iv) Improved Cooking Stove (ICS). Subsequently, the research team developed concept notes for each technology and prepared a detailed implementation plan.

The fourth step was about facilitating the capacity building of the communities involved. The research provided trainings on various themes, organised exposure visits, and conducted theme-based discussions with local communities and sector level specialists. These included participation by government representatives. Among various activities, exposure visit was found to be very effective for adult learning.

In the fifth step, the research focused on implementation of the research activities. The major activities included creation of baseline (technical and socio-economic), development of action research and implementation plans, and finally field implementation in collaboration with the stakeholders. The sixth step concerned monitoring, evaluation, and documentation of evidences of change. The research used the participatory process of monitoring and evaluation by using community members, district professionals, and national level experts. These M&E functions were carried out through informal interactions as well as formal meetings. The research started its learning and documentation process from the early stage of the research cycle but it was more concentrated in the later part of the research implementation phase.

From the documentation process, the major lessons can be drawn as below:

- The action research methodology needs to fully consider the local context, adopt a mixed approach of quantitative and qualitative research methods, and ensure scientific rigour in order to get consistent, valid, and reliable results. The research also needs to consider the longer time frame of the action research for managing ecosystems and implementing an iterative process to get more trustworthy research data and findings.
- It is important to consider the proper ecosystems risk assessment by using a longer term environmental/climate and socio-economic data/trend for better articulation of the scenarios.
- The use of participatory process is central for action research. It is a really useful approach not only for easy identification of local situations and getting their support in research implementation but also to engender the sense of local ownership over the process so that participating communities can take the outputs of the research further even after the completion of the research.
- Partnership-based work across various levels is useful for an action research to improve both the local-level ownership and district-level coordination, as well as to create an interactive platform for bringing new ideas from diverse perspectives.
- Capacity-building on socio-economic drivers and issues of climate change impact is important in ecosystems-based management. Hence, trainings (such as possible impact and adaptation measures) were helpful to design and implement the action research. In addition to regular in-house training, exposure visits were also found to be very useful, as they provide opportunities to observe the good cases and interact directly with innovative farmers. This is especially useful for adult learners.
- Managing expectations of local communities in real world situations is challenging. Negotiations between local needs and technical requirements of the action research are unavoidable. To address this, both technical and managerial skills of implementing agencies were important while managing the research. Continuous questioning and improvement in action research process and mechanisms led to better management by addressing emergent and integrated views while undertaking the research.
- The participatory monitoring and evaluation process provided an opportunity for self-reflection and improvement. The action research also put an emphasis on 'reflection' and 'improvement'. Because of this, the participatory monitoring and evaluation mechanisms put in place helped integrate M&E functions into the very design of the research.
- The documentation of credible evidence outside the scope of the action research is important to figuring out how learning from the research can be shared with a wider audience.

Based on the analysis from this study, following areas of improvement are proposed in order to make an action research even more effective in the future.

- Research methodology with stronger statistical provisions needs to be considered from the very beginning of the research design and appropriate human resources have to be engaged for the management of the research.
- Considering the complex nature of ecosystems management and the multiple drivers impacting socio-ecological system, it is highly important to consider the key drivers of ecosystems change, including climate change that will provide more opportunities and threats of ecosystems management in research areas.

- A clear research protocol (technical detail of research) with clear roles and responsibility of research participants is required for effective management of action research.
- Learning focused monitoring and evaluation was considered from the research design phase. While the participatory process is highly valuable, systematic periodic assessment provided validity and credibility to the findings for evidence-based decision making.

1. Introduction

The diverse ecosystems found in Nepal are a major source of ecosystem services directly supporting more than 70% of the rural communities (Pant et al., 2012; Sharma et al., 2015; Paudyal et al., 2015; Merriman et al., 2017). The low-income economy is highly dependent on ecosystem services and other natural capital, including tourism (Nepal, 2012; Birch et al., 2014; Paudyal et al., 2017), and they value it as a significant source of their wellbeing (Oort et al., 2015). Natural capital makes up about 31% of Nepal's national wealth (World Bank, 2006) and it is one of the most important means of adaptive strategy for numerous drivers of change (Bhatta et al., 2015). It is estimated that the total contribution of environment-related income to the country's economy may be over 50% (Sharma et al., 2015). Agriculture, combined with forestry and fisheries, accounts for more than 38% of the country's GDP (World Bank, 2008). Significant portions of the power, water, manufacturing, trade, and tourism sectors are also dependent on the mountain ecosystem of Nepal in one form or another. It is estimated that the forestry sector alone contributes 15% to the GDP of the country (MoFSC, 2009). Similarly, non-timber forest products contribute about 5% of the GDP. Tourism, much of which is nature-based, provides about 2% of the total GDP and about 25% of the total foreign exchange earnings (MoFSC, 2010). Therefore, the wise management of ecosystems and the derived ecosystem services can be a key to sustainable economic development and poverty alleviation strategies in Nepal (Peh et al., 2016; Thapa et al., 2016).

There is an urgent need to comprehend the complexities of the ecosystems and the socio-ecological system related to its management so that appropriate policies and strategies can be developed to address emerging threats to ecosystems and to enhance services to benefit both nature and humans alike (Pascual et al., 2017). The Support to Rural Livelihoods and Climate Change Adaptation in the Himalaya (Himalicala) initiative is aimed at supporting poor and vulnerable mountain communities in the Himalaya to mitigate and adapt to climate change impacts through collaborative action research and pilot activities. The objective is to help build the capacity of institutions working on resilience to climate-induced vulnerability, which will subsequently improve the livelihoods of the mountain communities in the Himalaya. However, it is assumed that adaptive capacity can only be attained when the socio-ecological system and the value of ecosystem service provided by mountain communities to themselves and those downstream is understood, recognised, and maintained (Rasul et al., 2011; Grêt-Regamey et al., 2012; Thapa et al., 2016). Thus, ICIMOD, in collaboration with BCN and Nawaprabhat Nepal, conducted an action research to enhance understanding and trade-off between conservation and development in Rauta VDC, Udayapur District, Nepal.

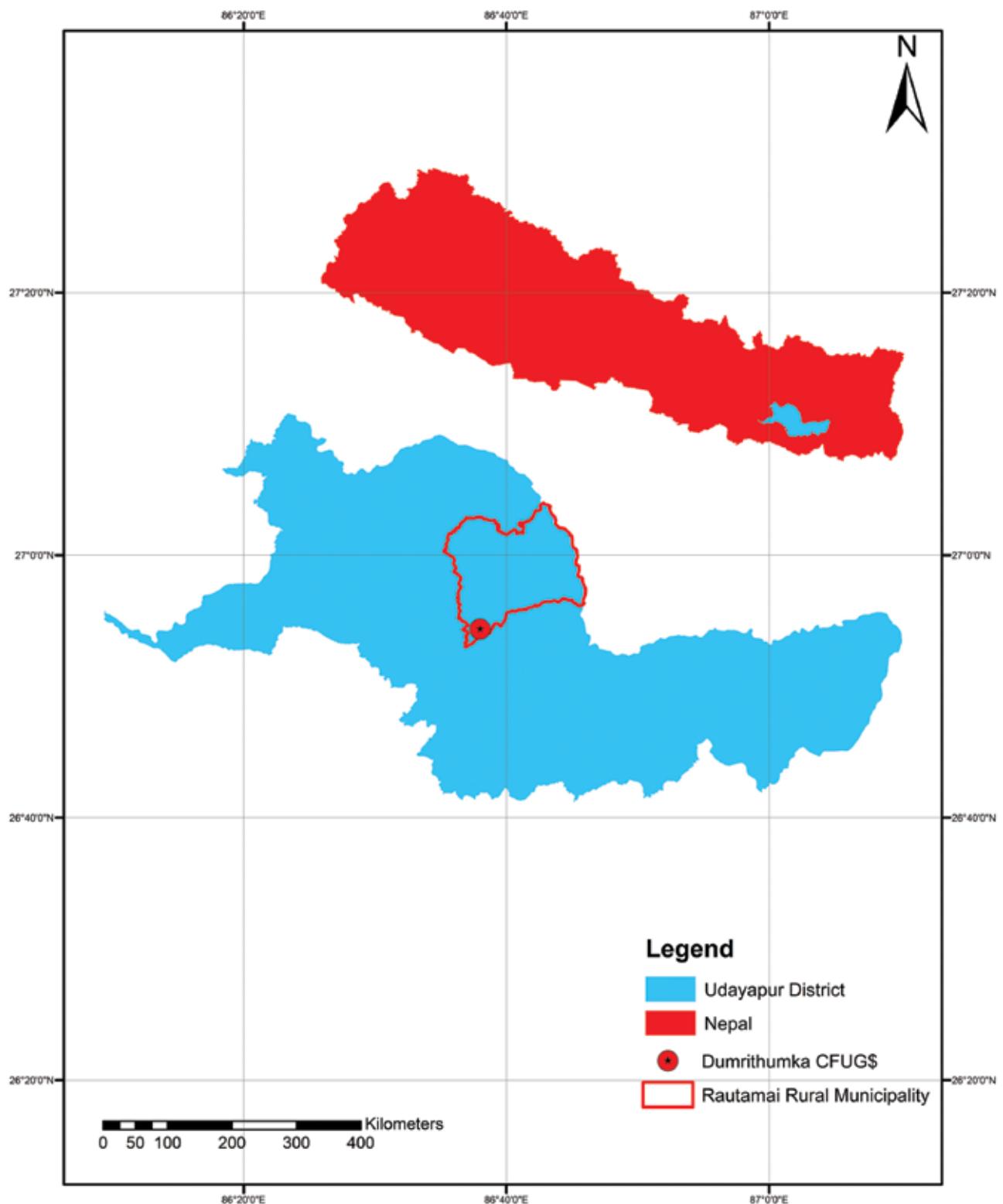
1.1 Background

ICIMOD, with support from European Union, launched the programme 'Rural Livelihoods and Climate Change Adaptation in the Himalayas' in order to enable and facilitate the equitable and sustainable well-being of the people in the HKH region. The specific objective of this programme was to support the development of mountain rural livelihoods and the conservation of HKH ecosystem assets and services through active regional cooperation. The programme has five main themes and one of them is strengthening collaborative action research. 'Ecosystems services' within this theme was considered as important for enhancing rural livelihoods and climate change adaptation in the Himalayas. The specific objectives of this component were as follows:

- Develop a research framework and methodology applicable in the HKH to assess ecosystem services of potential research areas or landscapes;
- Identify and assess ecosystems from the study areas and prepare technical reports;
- Develop, share, and mainstream the knowledge produced for effective planning and management of ecosystem; and
- Conduct action research on ecosystem management.

ICIMOD, BCN, and Nabapravat worked together on the fourth specific objective (i.e., conduct action research on ecosystems management). ICIMOD and BCN signed a Letter of Agreement (LoA) in January 2014 to undertake an action research in Rauta VDC of Udayapur district (Map 1) from Jan 2014 to Dec 2016 with the objective

Map 1: Map showing the research sites



of identifying practical solutions for improved ecosystem management through conducting collaborative action research on alternative livelihood options.

1.2 Scope of Work

While the support to the Action Research was ongoing during this study, ICIMOD aimed to initiate systematic documentation of process of this collaborative action research and draw some lessons that can be used in the future in similar thematic areas.

2. Action Research in the Face of Climate Change

The main task of the review was to document the process of an action research related to ecosystems services based adaptation to climate change. However, the discourse is evolving and there exists diverse understandings on a couple of issues. Thus, a brief review of the conceptual aspects on these issues is necessary.

2.1 Action Research

Process documentation is about recording various processes of the research cycle. Although the process documentation will not assess the quality assurance part, it provides important links to understanding and improving theory-based interventions that can be applied to future researches or programmes.

Action learning has different meaning to different people (Weinstein, 1995: 32). According to Raelin (2000), action learning is an educational strategy used in a group setting that seeks to generate learning from human interaction arising from engagement in the solution of real-time work problems. All action learning approaches are philosophically rooted in theories of learning from experience as practiced in a collaborative way with other stakeholders. These theories are influenced by the assumption that human beings can shape their environment and that the value of scientific method is in the pursuit of improving human condition.

In the case of natural resource management discourse, the value of action learning approach is increasingly realised. It is important in collaborative natural resources management, especially when there is no adequate information available from the past experience and the discourse is evolving. According to Probst et al. (2003), the main objective of the action research on natural resources management is to enhance adaptive management capacity and social capital at the local level.

2.2 Action Learning in the Face of Climate Change

Tackling climate change requires greater attention for reflection and learning (Tanner et al., 2012) because it introduces new sources of uncertainty and complexity about how it may impact existing socio-ecological systems and how these systems may evolve over time. Due to these complexities and lack of available knowledge, there are multiple and competing understandings among the stakeholders on how to respond to the impacts of climate change in short and long terms.

Exploring opportunities and options from ecological systems are increasingly considered as an important strategy to address the climate change risks in the longer term. But due to the complex nature of the interactions between society, ecosystems, and climate change, it is a very challenging task to have simple solutions that can be adapted by communities immediately. Thus, the identification of ecosystems-based adaptation measures requires a systematic and longer term investigation of socio-ecological systems in the changing climatic context. While the discourses about the knowhow, tools, and processes are evolving over the years, developing ecosystems-based adaptation measures needs to consider local-level impact, future scenarios, the needs of local communities, and the costs of long-term solutions. Thus, it is important to note that the conventional research and development approach that focus on achieving predefined programme logic within narrow scope cannot serve the purpose of identifying climate resilient solutions by using ecosystems services in the existing complex socio-ecological systems. This demands systematic action learning to understand these complex processes and identify the site-specific adaptation needs by following a clear process of plan – action – reflection – learning – improvement through an iterative process in close collaboration with local communities and stakeholders.

3. Methodology and Conceptual Framework of the Study

The study employed a participatory inquiry approach. The study undertook a review of various programme documents, analysed research reports (baseline, annual reports, and others), carried out a review of literature, interacted with various stakeholders (communities and line agencies), and undertook a transect walk to know various processes undertaken by the research and perspectives from the concerned stakeholders.

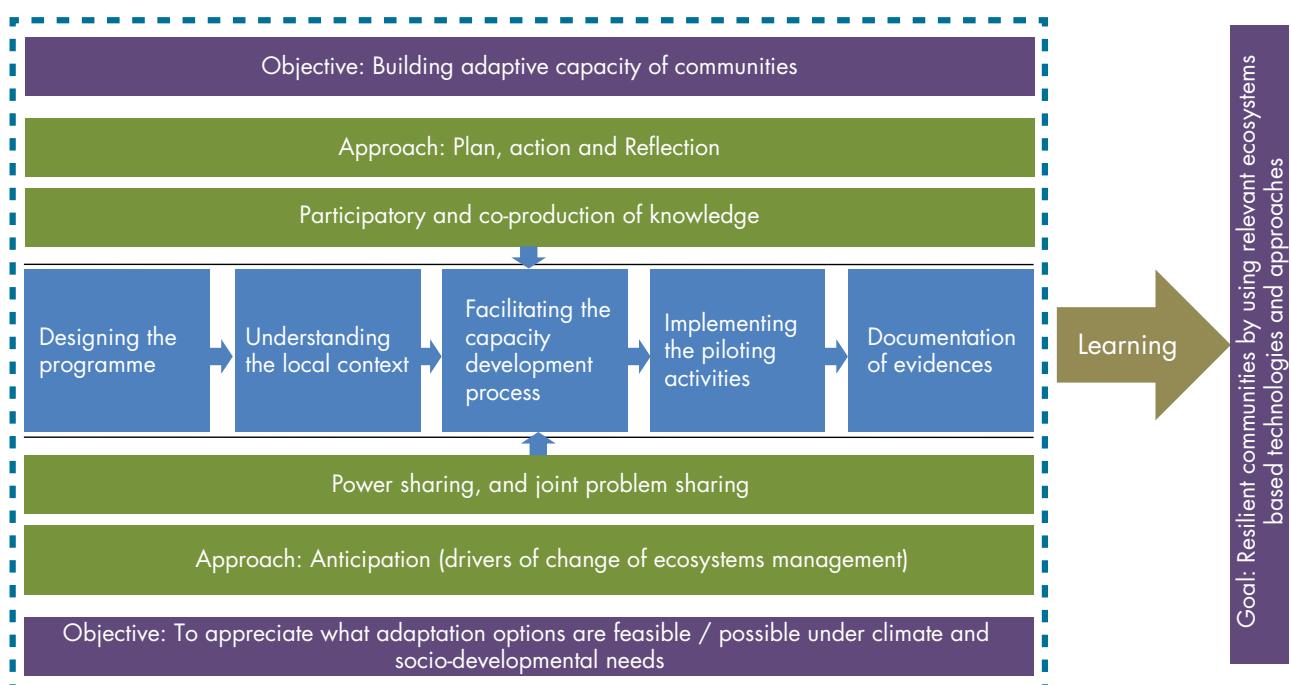
A checklist with sub-questions was prepared in the beginning in consultation with ICIMOD staff to gather information on the process adopted by the research and lessons learnt during the research planning and implementation. The open-ended questions provided opportunities to ask several probing questions before reaching to a conclusion. Altogether, two FGDs and five KIIs were carried out in the research sites, whereas representatives from local partners and three districts line agencies were also met. Experts from ICIMOD and BCN were met at various stages of the review.

The study followed the following processes for the study:

1. **Review objectives and approaches of the research:** Reviewed the programme/research documents to identify the main outputs and expected outcomes, major performance indicators, and strategies considered to achieve the objective.
2. **Review the research planning and implementation:** Assessed approaches used in identifying local stakeholders and research sites, understanding the context, planning the research activities, enhancing the capacity of stakeholders, implementing the interventions, as well as monitoring and evaluating the documentation of evidences.
3. **Document the process and draw lessons from the research:** Documented processes adopted by the research, drew lessons in each phases of research cycle, and provided some recommendations for future use.

Based on the nature of the research as mentioned above, a conceptual framework was developed to assess the major process adopted and the lessons learnt from the research (Figure 1).

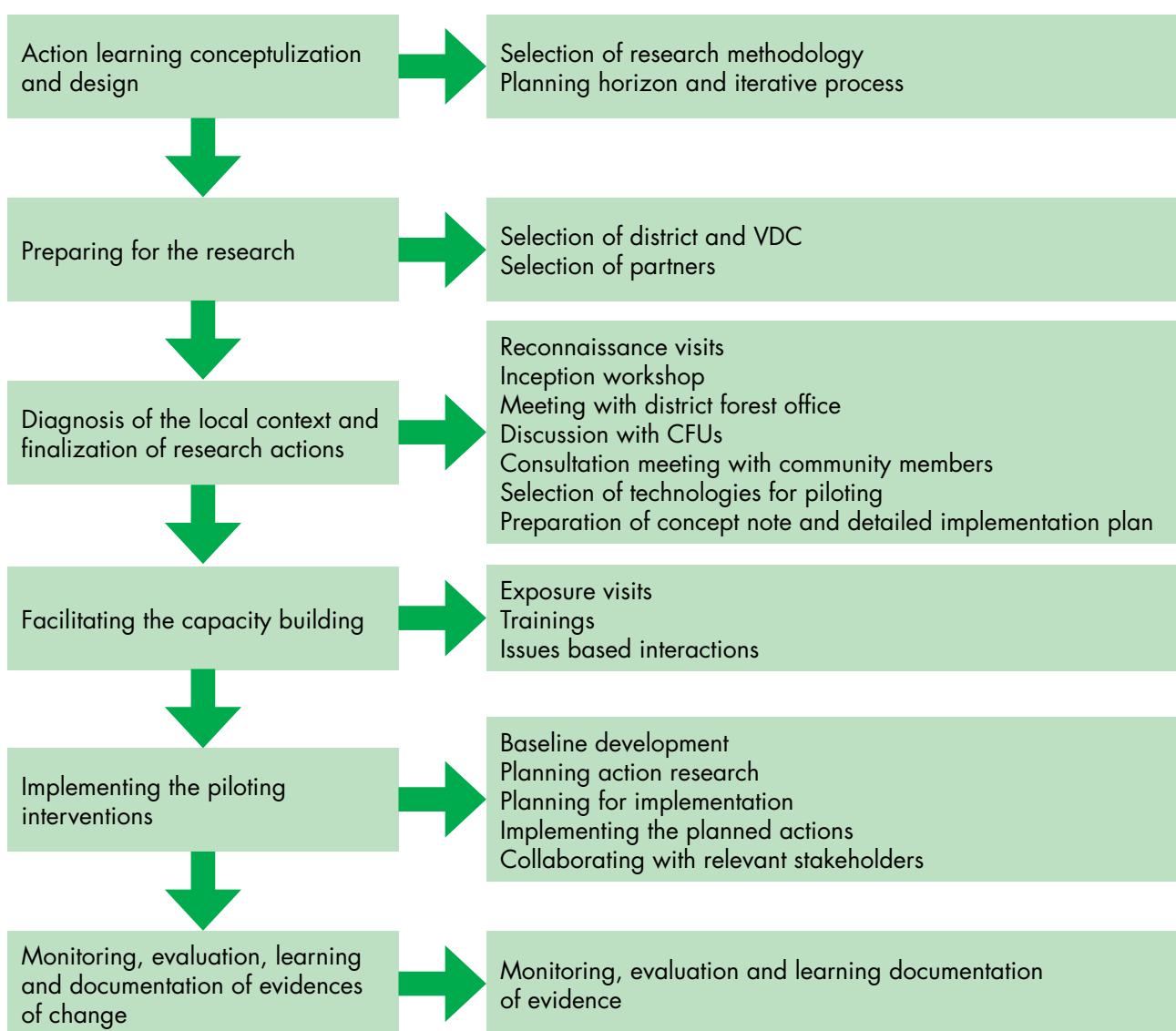
Figure 1: **Conceptual framework of the study**



4. Processes Adopted in Action Research

The review of the design of the research and different phases of the research management, as well as the discussions with stakeholders (communities and districts line agencies), revealed following phases and processes (Figure 2). The main phases for the research included: i) action learning conceptualisation and design, ii) preparation for the research, iii) diagnosis of the local context and identification of research action, iv) facilitation of the capacity building of the communities and stakeholders, v) implementation of the piloting intervention at the community level, and vi) monitoring and documentation of evidences.

Figure 2: **Major steps adopted during the action research implementation**



The following chapters will provide a brief description of the phases and processes, while also documenting the major learnings from those processes.

4.1 Step I: Action learning conceptualisation and design

According to the HIMALICA programme document, the objective statement of this action research is:

'to identify the practical solutions for improved ecosystem management through conducting collaborative action research on alternative livelihood options to show visible impact at the ground considering socio-economic and ecosystem health as indicators.'

Quality assurance of a research starts from research conceptualisation and design phase. Although the research can be designed in a way that allows the research management team to improve continually during the detail planning and implementation stages, the research design phase should consider various quality standards for action research. The review of research showed that the main objective of this research within Himalica was developed by consultants with limited consultations during the phase of grant approval. Thus, the initial idea of this action learning research was conceptualised at the broadest level, with a flexible understanding of the general Nepalese context. It is also noted that the action research component within the Himalica programme document was very small. Due to this, there was limited opportunity to assess the various kinds of quality standards that are required for action research on ecosystems services in the changing context through the programme document. There was, however, a slightly extended version of concepts and methods available while developing a letter of Agreement (LoA) between ICIMOD and BCN to operationalise the research in the sites. During the LoA process, the two parties discussed various issues related to ecosystems services, livelihoods, and climate change, and these issues were reflected in the LoA. The process helped consolidate various perspectives in more concrete ways.

In this context, the quality standard of research in design phase was reviewed by considering three aspects: the relevance of the research for the local communities, proposed research methods, and consideration of longer term nature of the ecosystems management. These processes are briefly described below.

4.1.1 Relevance of the research

The nature and extent of the relation between ecosystems and society have changed due to the recent effects of climate change. This research has rightly captured this issue. The action research aimed to develop some practical solutions for ecosystems-based management and adaptation that are useful for the communities. Hence, the research objectives are highly relevant to local and national needs.

4.1.2 Research methodology

A good action research requires a robust research methodology. The research undertake a placed-based collaborative approach considering evidence based practice (EBP) to manage and assess the achievement of the research. Harris et al. (2001) provided three levels for generating evidences from a research. Level I is randomised control trial; level II is quasi-experimental design; and level III is credible participatory inquiry. All these levels follow evidence generating process based on various types of assessment tools and methods. However, the scientific rigour of these levels in terms of establishing the cause and effect relations is varied. Randomised controlled trials (level I) are often considered the 'gold standard' in establishing cause and effect relations (Norcross et al., 2006), but they have their own limitations of applicability in local contexts. In real life situations, it is difficult to assign 'control' and 'treatment' randomly. It was noted that the research has used level II and III evidence generating process based on the types of technologies. For instance, the research has used well designed cohort or case-controlled analytical studies for using ecosystems indicators by establishing 'grazing control plots' (treatment) within community forests (level II – quasi-experimental design), whereas for other technologies such as home garden the research adopted the methods of collecting 'opinions of credible authorities' based on grounded experience, descriptive studies, and other reports (level III – participatory inquiry).

For data collection and synthesis, the action research employed a mixed method. The research team collected both quantitative and qualitative data by using household survey as well as participatory tools such as FGDs and case studies. The variables to be studied were designed and decided as per the research plan. Quantitative data was collected in a way that could be used to identify relationships and patterns of dependent and independent variables of the research. Qualitative information was used to analyse behavioral change and analysis of preference/options.

While collecting data/information, the team also assesses major themes and theoretical models that would help identify the possible explanations for the observed behavior.

The analysis showed that for the collaborative part of the research, where communities were involved, behavioral patterns and livelihood concerns played important roles in managing action research and identifying methodology for generating evidences. Given the need for cause and effect relations of variables in order to demonstrate the plausible results from the research, it is ideal to have a well-designed controlled trials. But this is not always possible in this type of collaborative action research where some tough negotiations have to be made considering the field context. Thus, quasi-experimental design for the 'grazing control' is justifiable. But to make the design robust, the research could have followed a similar process for other interventions (such as ICS) as well. In addition, the data collection process had some challenges regarding sampling design and sample size, and these processes could have been planned well during the planning process.

4.1.3 Research time frame and iterative process

This research has considered socio-economic and ecosystems health as indicators for identifying practical solutions to improved ecosystems management and sustainable livelihood of the communities. In order to assess the ecosystems indicators and witness the improved performance of ecosystems through a set of reliable evidences, a longer time frame is generally required, i.e., at least 5-7 years of continuous work.

Another important aspect of the ecosystems related research is the validation of findings through a couple of iterations¹. This is required as various environmental factors, including climate change, have altered the ecological structure, functions, and processes. In this case as well, it would have been good to have at least two iterations of the research in order to get more plausible research findings. As ecosystems management itself is a set of complex issues and there exists very limited knowledge or previously established facts of cause and effect relations, multiple cycles of actions and reflection would enhance the power of evidences by discarding unnecessary and random observations in the research process. This is a very important strategy, especially in the context of complex socio-ecological processes when there are many drivers of change including climate.

Although this learning research has recognised the value of iterative processes of planning – action – observation – reflection in its research document, the research was designed only for three years. This was due to the limited nature of the Himalica programme.

4.2 Step II: Preparing for the Research – Selection of Sites and Partners

4.2.1 Selection of district and VDC

Udayapur district is one of the richest districts in terms of ecosystem diversity and release of ecosystems services. But the ecosystems in the district are also at risk. The district is vulnerable to climate change. The climate change vulnerability assessment report (MoE, 2010) showed that the district is highly susceptible to climate disaster such as floods. Within the district, the research team analysed current climate change risks (such as landslide, soil erosion, floods, and forests fires) and potential vulnerable communities from climate change risks. On the basis of the analysis, some potential VDCs were selected.

The research in consultation with district line agencies then developed some specific criteria to select the VDCs. The criteria included: i) observed climate change events (in the past and present), ii) potential climate change risks, iii) prior experience of working by the implementing agencies, iv) vulnerability of forests ecosystems from climate change, v) community interest, and vi) accessibility of the research sites from district headquarters. By using these criteria, Rauta VDC was selected based on its high level of vulnerability to climate change risks (high soil erosion and landslide and potential risk for forest fire), deep interest from the communities, and accessibility of sites from the district headquarters. In addition, ICIIMOD had done prior work in the VDC.

¹ Iteration is a design or framework that allows repeating round of analysis and process of refining before arriving at desired results.

4.2.2 Selection of partners at the national level

Very few organisations are working on ecosystems services and climate change issues in Nepal. Bird Conservation Nepal (BCN) has been working with an ecosystem services perspective focusing on bird conservation. It has implemented some researches including Darwin Initiative's research on 'understanding, assessing and monitoring of ecosystem services for better biodiversity conservation' in three Important Bird Areas (IBAs) with the support of Birdlife International. Those researches provided some rich experience to BCN for work on this research. In addition, BCN also expressed its deep interest in the issues that this research aimed to explore. Thus, based on some prior experience and deep interest of the BCN, ICIMOD and BCN joined hands to work together on this research.

According to the Letter of Agreement (LoA), BCN is responsible for providing technical expertise for research and facilitation of activities while conducting an action research. Some of the major activities included:

- Preparing a detailed implementation plan,
- Raising awareness on the potentialities of ecosystem management,
- Promoting high value products,
- Rehabilitating the degraded forest through bioengineering,
- Promoting alternative options to minimise pressure on forest, and
- Promoting kitchen gardens as alternative sources of income in pilot basis.

4.2.3 Selection of a partner at the district level

The main objectives of hiring an NGO at the district level were to: i) develop good rapport with local communities and understand the local context better, ii) facilitate community mobilisation and support local level activities implementation, and iii) coordinate/collaborate with district level stakeholders. In order to hire an NGO in a transparent way, following processes were followed.

- Prior information notice was issued to all relevant non-governmental organisations working in Udayapur district;
- Consultation meeting and discussions were carried out with participating organisations to share the selection criteria for an NGO:
 - Partner organisation was to be locally registered,
 - Partner organisation was to have relevant work experiences in natural resources management area, and
 - Partner organisation was to have good coordination and network among different governmental and non-governmental line agencies;
- Potential organisations were shortlisted;
- One to one interaction with the shortlisted organisations were conducted on different aspects of the organisation, including operational structure, human resources, annual financial transaction, relevant work experiences, networking, and coordination; and
- The final selection of one local level implementing partner was made.

From a list of application, the research team shortlisted two NGOs based on their prior experience on community mobilisation and work on climate change and ecosystems services. It was difficult to get an NGO that fulfilled all the criteria, but based on some experience of working on disaster risk reduction, institutional ability, interest on the research issues, and potential ability to engage communities and district stakeholder, Nawaprabhat Nepal was selected as the district NGO partner.

4.2.4 Identification of the roles of stakeholders

The research designated specific roles and responsibilities to each organisation involved in the action research process. ICIMOD was responsible for overall oversight of technical matters, as well as for bringing international learning, providing thematic input on ecosystems services and climate change issues, regular monitoring of research activities, and providing mentorship to the field staff. BCN was responsible for bringing national technical expertise and managing the research at research sites, whereas Nawaprabhat Nepal was responsible for implementing local level activities, clarifying local context, and coordinating with local stakeholders. All these roles and responsibilities were also explicitly mentioned in the LoAs.

The discussions with partners and research staff showed that the research mostly managed all these given ToRs as per the plan. There were, however, some issues regarding the relatively weak technical mentoring support in the beginning of the research implementation, which was later resolved through the staff capacity development and regular joint monitoring process.

The involvement of local stakeholders was found be helpful to understand the context and obtain a smooth implementation of the research. The required technical support was provided by BCN, whereas the field level implementation was carried out by Nawaprabhat Nepal. It was noted that Nawaprabhat Nepal played a vital role in the overall implementation of the research activities. The consultation showed that having a local partner helped to get local perspectives in the research process and supported the facilitation of day to day activities, ensuring greater ownership by the community.

4.3 Step III: Diagnosis of the Local Context and Identification of Research Action

The research carried out some specific events to understand the context and to develop some strategies for research implementation. These are briefly described below.

4.3.1 Reconnaissance visits

At the outset, the research team organised some reconnaissance visits in the research sites to understand the local context and to develop good rapport with local communities. The local context analysis² helped to link research objectives with local context, triangulate with local needs, and identify partnerships modality with local communities. The process helped to increase the local level awareness and ownership over the process.

4.3.2 Inception workshop

The research organised a three-day inception meeting on 27-29 January 2014. The objective of the inception meeting was to inform the line agencies, concerned local stakeholders, and Community Forest User Groups (CFUG) about the research and its objectives, focusing on the role of ecosystem services in climate change adaptation and how some piloting studies can be done in the area. In addition, the workshop also intended to gather concrete suggestions on action research from CFUG members based on the draft of the concept note on the action research.

The inception workshop adopted the following process:

- Briefly sharing the understanding of local context,
- Sharing the research objectives,
- Collecting expectation in terms of what they would like to see in their ecosystems,
- Sorting these expectations into two categories vis-à-vis social and ecological importance,
- Scrutinising the expectations with the scope of the research, and
- Presenting them in a visual form.

The workshop was attended by the representatives of seven CFUGs from Rauta VDC and relevant stakeholders. The meeting provided opportunities to local participants and stakeholders to share their needs and expectations from the research.

As a part of the inception programme, a focus group discussion was organised on 28 Jan 2014 at Nepaltar Range Post, Murkuchi. A field visit was also organised to observe the regrowth of Khayar (*Acacia catechu*) forest in the Annapurna Community Forest after the discussion. From the visit, Khayar plantation was considered as an option for the action research along with the introduction of other various non-timber forest products (NTFPs).

The research used some good participatory tools during the inception workshop. These tools helped communities to understand the interrelation between ecosystems and their livelihoods needs and the possible results if ecosystems are not properly managed. One of such tools was a visual village resource map.

² In this research , the context analysis is considered as a process to understand the local needs and resources, explore climate change risks (current and future), assess level of ecosystems management, identify and discuss the challenges related to research interventions, and devise appropriate implementation mechanisms in the research site, among others.

The discussion with the communities revealed that visualisation³ process, i.e., the village resource map (photo 1), helped communities to share their ideas into a common visual. This was immensely effective to communicate and raise awareness in the communities as a way of making a clear picture of available natural resources and physical assets, highlighting their statuses, and showcasing possible options of management. The interaction in the research site revealed that this was a very good tool for adult learning, which ensured interactive participation from communities for better analysis and finding solutions from the communities themselves.



Photo 1: Village resource map

4.3.3 Meeting with District Forests Office (DFO)

A follow-up meeting was organised with the DFO on 29 January 2014 after the inception meeting. The main objective of the meeting was to finetune the main themes of the research priorities, including identification of appropriate indicators related to climate change issues and ecosystems while considering the needs of the local people. The meeting also confirmed the criteria for selecting the CFUGs for the research. They were:

- Existing climate change risk of the CFUGs,
- Level of participation and interest,
- None or limited entanglement with political power, and
- Accessibility.

4.3.4 Discussions with CFUGs and selection of a CFUG for the research

Once the criteria for selecting the CFUGs were developed in consultation with the DFO, the research team organised some informal group meetings and focus group discussions with the representatives of three potential CFUGs (*Dumrithumka CFUG*, *Nawajyoti CFUG*, and *Trishakti CFUG*), separately in their respective villages. These meetings enabled the research team to understand and analyse the CFUGs needs and their interest to work in collaboration. Based on these discussions, the team used its selected criteria to identify an appropriate CFUG for the research. Based on the four criteria (as mentioned above), one CFUG was eliminated as there was a high chance of political influence in the research activities while another was rejected due to its low level of active participation on research issues. Hence, finally *Dumrithumka CFUG* was selected for the action research.

4.3.5 Consultation meeting with users members within the selected CFUG

Once the CFUG was selected, the research organised a consultation meeting with the general user members of the CFUG at Dumrithumka on 14 February 2014. The research team informed the members about the research scope and objectives, and it inquired about their interest or willingness to participate in the research activities. Informal interviews were carried out to properly understand the situations and possible opportunities to work with them.

4.3.6 Selection of technologies for piloting

The context analysis and consultations with local communities provided ample opportunities to the research team to get a fairly good understanding of the local situations. After this, the research team focused on technical aspects of the research. The research team discussed with the selected communities about what could be done with the given resources in the given time frame while considering research objectives and livelihood needs of the people.

³ Visualisation is an effective participatory tool at local level especially for adult learners. Visualisation is a written communication process of making ideas visible through illustrations (drawing, picture, poster, or diagram) and helping groups to better understand and internalise a concept or idea.

After various levels of consultations with the CFUGs and community members, a long list of possible action research themes was created. With the support from the DFO, the list was reduced to six themes with technical requirements and feasibility of the research in mind. The six identified themes were as below:

- Zero grazing plot for degraded forest regrowth,
- Reforestation of soil erosion area,
- Promotion of home gardens,
- Green river embankment,
- Promotion of Improved Cooking Stove (ICS), and
- Forest fire management.

After further discussions with the involved communities, four out of these six research themes were finally selected for the action research based on the need, relevancy, cost, and technical feasibility. Although the two remaining technologies were considered equally important, they were deemed relatively costly to implement with the given resources. The four research themes or technologies that were selected were as follows:

- Zero grazing plot for degraded forest regrowth,
- Reforestation of soil erosion area,
- Promotion of home gardens, and
- Promotion of Improved Cooking Stove (ICS).

4.3.7 Preparation of concept note on the action research and detailed implementation plan

After the identification of action research themes, concept note and detailed implementation plan were prepared for each theme by the research team. The concept note included:

- Background
- Objective
- Targeted beneficiaries
- Area
- Methods/activities
- Expected outputs

The concept note and implementation plan were then shared with communities to get their response. The plan was also shared with the ICIMOD team and necessary inputs were provided by respective experts to improve the concept note. The review showed that concept note and implementation plan provided an opportunity to explore research issues in detail and laid out the challenges while carrying out the actual implementation. The implementation plan helped to know who would be responsible for which activities and when they were expected to play a role. Clear roles and responsibility were considered helpful to manage the research efficiently.

Some observations from participatory diagnosis process

The participatory based context analysis provided a deeper understanding of the local situations (such as livelihoods, demography, gender, ecosystems services, natural resources, climate change risk, and communities at risk from climate change, among others) and helped to link these local contexts with research objectives. This process enabled the team to come up with a robust and resilient research implementation plan. In addition, the process also helped to identify partnerships modality with local communities for research implementation for each of the research interventions. The process not only made the planned activities realistic but it also helped to secure the trust of the communities and district level stakeholders (Box 1).

Despite these positive aspects, the study also revealed that participatory process needs to be handled very carefully. It not only required the research staff to have good facilitation skills and common sense but also adequate technical knowledge and skills on this complex issue. In addition, communities in most of the rural areas were not aware of the climate change and how it may impact ecosystems management and vice versa. Hence, it was an important task to make the stakeholders aware of climate change first by providing some evidences of climate change impacts on people's livelihoods and follow it by discussing possible climate risks in the future that could impact socio-ecological systems. In this case, tools such as brainstorming, mind mapping, historical trend analysis, and cause and effect analysis would be useful.

Box 1: Local participation was considered as important vehicle for collaborative research

The research team and district stakeholders viewed that the participatory context analysis provided opportunities to identify the main concerns of communities, types and nature of ecosystems services that can be used for adaptation purpose and the readiness of the communities to participate in the research activities. The process helped to know the local situations and knowledge on these fundamental issues in a bid to identify ecosystem based adaptation. It also helped to identify and make the community aware about the root causes of the problems – both direct and indirect, short and long term. In addition, such diagnosis has also provided options to attain research objective and encourage communities to use their existing strengths in achieving common/collective goals at community level.

In specific, the diagnosis process helped to:

- Help to identify the specific issues and their associated challenges/barriers and opportunities
- Helped to characterize the level of complexity of the problem and assess the major ways to address these issues
- Understand the local interests, needs and common objective on the issues
- Help to devise mechanism to develop mechanisms for creating awareness
- Prioritize the intervention areas considering the socio-ecological dynamics

The local communities also agreed on these outcomes. "We were consulted from the very beginning of the action research. So, we could talk about our immediate problems and asked if that could be incorporated in the AR. We felt ownership as all the interventions were discussed with us" says one of the farmers in the research site.

However, the review noted that context analysis was mainly focused on current situations and there was inadequate consideration of future climate risk analysis of climate change. This could be due to inadequate climate and hydrological scenarios available for this area.

4.4 Step IV: Facilitating the Capacity Building Process

After the identification of possible technologies to be tested, the research focused on building capacity of stakeholders and research staff to manage the change process effectively. The capacity development process was primarily guided by the objective of the research and the context analysis. The research determined that the capacity building is essential in making the stakeholders aware of the intrinsic relation of climate change with ecosystems and livelihood and in managing the research activities effectively.

The main objectives behind the capacity building of the stakeholders were: i) to provide them with information and understanding about the context and to enhance their confidence about the action research (awareness/knowledge); ii) to develop appropriate skills and ability to plan, implement, and manage the interventions (action); iii) to ensure reflection and learning as per the objective of the action research (reflection); and iv) to enhance ability of research partners to improve through self-reflection and learning. For this, it is important to build absorptive, adaptive, and anticipatory capacity of communities to identify appropriate adaptation options that are feasible to address existing and future climate risks. Adaptive capacity, particularly from a systems perspective, has been described as the ability to learn from mistakes (Adger, 2003), to generate experience of dealing with change (Berkes et al., 2003), and to be capable of innovation (Armitage, 2005). In fact, under climate change, enhancing adaptive capacity implies paying explicit attention to learning about past, present, and future climate threats, accumulated memory of adaptive strategies, and to anticipate and prepare for surprises and discontinuities in the climate systems (Nelson et al., 2007).

The study revealed that communities and local institutions did not have adequate awareness and capacity to plan, monitor, and implement ecosystems based adaptation while the research was initiated. The discussion showed that it was difficult for them to get the right information on time as the knowledge in this theme was fragmented and

imperfect. It was difficult for them to establish cause and effect relations in climate change impact on ecosystems and livelihood. It is noted that the research provided many consultative meetings, exposure visits, and training to communities to enhance the capacity of the communities.

4.4.1 Exposure visits

One of the important strategies taken by the research was to develop capacity through organising various exposure visits to communities and stakeholders. The exposure visits were designed to provide broader learning opportunities for them by making it more interactive and reflective. The main purpose of these exposure visits were to learn from other innovative farmers and share among themselves the experiences gathered from various places they visited. The specific objectives of the visit were:

- To enhance participant knowledge through exposure visit to the areas of best practices in ecosystem management;
- To promote exchange of ideas among the stakeholders;
- To empower the team to adopt sustainable ecosystem management practices; and
- To foster cooperation, partnership, and network among the district level line departments to address the issues related to ecosystem and natural resources management as well as livelihood improvement of the local people.

Three types of exposure visits were organised for the communities and stakeholders. They are briefly described below.

The first exposure visit

The objective of the first visit was to sensitise the stakeholders about some major issues on the link of climate change, ecosystems, and livelihood, as well as to provide a platform for the members of the CFUGs to learn from the site. A three-day exposure visit to Mahottari and Ilam districts was organised for eighteen participants including members of ten CFUGs, and various stakeholders (VDC, District Agricultural Development Office, District Soil Conservation Office, NGO Federation, and FECOFUN) on 25-27 April 2014. The exposure visit provided an opportunity for communities to interact and exchange knowledge, skills, ideas, information, and technology with each other (Photo 2). The visits also provided opportunities to learn many good practices of rehabilitation of degraded lands and about the home garden improvement programme.

The second exposure visit

This visit was mostly targeted to show some specific innovative options for ecosystems management and livelihood enhancement to the farmers of Dumrithumka community where the action research was carried out. The main aim of this visit was to help community members to learn from the experiences from other groups from various part of the country. It was found that the visit helped them to understand the potential of new options that can be adopted in their context as well. The six-day visit (25-31 May 2014) with 25 persons (20 participant from Dumrithumka CFUG and remaining from district stakeholders) provided opportunities to interact with the communities in Chitwan, Nawalparasi, Rupandehi, and Kaski districts.

The review of the exposure visit demonstrated that the visit had some positive changes on participants' attitudes and behavior toward adopting new technologies and increasing interest to be actively involved in the research activities. The study noted that communities applied in the research implementation process what they learnt during the exposure visit. For example, after the exposure visit, about 80% of participating members (in the exposure visit)

Photo 2: Technology transfer during exposure visit



Seti Maya Sarki receiving Mulleto grass sapling from a user of Chelibeti CFUG (Chitwan)

were convinced about making their community free of open livestock grazing. Open grazing was a real challenge when it came to protecting new plantation within community forests and also to growing winter crop (such as wheat) in the communities. They called a village-level mass meeting and the exposure visit participants shared their learning from the exposure visit. They proposed making their communities open grazing free areas. Finally, their strong arguments convinced other community members why open grazing control was needed. As a result, the community developed a mechanism of controlling their livestock and goat, made hoarding boards to publicise this decision, and also implemented a penalty system if somebody disobeyed the community rules (Box 2).

The third exposure visit

The third exposure visit was organised to support the collaborative partnership between communities and district level line agencies. They visited similar sites as the second exposure visit. Different officials from district line departments along with school teachers, local men, and people from NGO federation participated in the visit. In addition, an interaction with ICIMOD officials in Kathmandu was also organised.

The exposure visit helped the research implementation in the following ways:

- This exposure visit was carried out before the implementation of the action research and the learning from the participants were very useful, even in developing concept note and preparing implementation plan.
- The learning from the visit was useful for technical management of the action research. Some of the participants also got specific skills during the exposure visit.
- The visit was also useful to settle other community development issues that were not part of the action research.

All these exposure visits helped communities, stakeholders, and the research team to build additional confidence about what they were doing and also to bring new ideas from outside. The exposure visits, therefore, helped in achieving a smooth implementation of the research activities. Discussions with communities pointed out that the exposure visits were critical in terms of convincing community members on research activities, developing confidence, and getting their support on the research activities. The possible reasons of this success could be due to the fact that the exposure visits helped to sensitise community members and encourage them to work on the research activities. As the participants had opportunities to see some innovative technologies, actions, and processes during their visits, it was considered as a big motivating factor for them to apply the same in their own context.

4.4.2 Training

The research provided many training to community members. The first type of training was related to general awareness of community members (such as information on climate change and sustainable forest management) and the second category of training was related to specific technical issues such as nursery management, high value agro forests products, home garden, etc. All these trainings aimed to enhance the capacity of the communities and improve their livelihood by enhancing the ecosystems. Some of the representative training provided to communities are briefly described below.

Nursery management trainings: A three-day training on nursery development and management was organised on 3-5 May 2014. Forty members from Dumrithumka CFUG participated in the training. Saplings of fourteen plant species were produced in the nursery, which have been managed by the community since March 2015.

Box 2: Voices from the second exposure visit

Geeta K.C., Secretary of *Dumrithumka CFUG* said "I am happy to visit Chelibeti women CFUG. We have noticed women empowerment, social inclusion and successful action research here. We will also do our best to make the action research successful in our CFUG".

Pasta Maya Kepchaki Magar said "I am excited with the practice of seed exchange which we can replicate at our village. We are encouraged to start home gardening at our home yard."

Mrs. Bimala Mijar, Ex-Member of Constitutional Assembly said "Women's active participation (even in decision making), sensitization is provoking. I am influenced by the women's role and activeness to declare the Devitar village (Chitwan) alcohol free" and I hope we can convince our people as well.

PRA exercises: One and a half day PRA exercise was conducted on 7-8 May 2014. Twenty-six local people participated from nine wards, and participatory tools such as resource mapping, pair-wise ranking, and focused group discussion were taught during the training (Photo 3).

Training to enumerators and Ecosystem Services

Assessment Household Survey: A three-day training was organised on 6-8 June 2014. Six enumerators participated in the training. The main objective of the household survey was to fill up the ESA household questionnaire forms from households of Rauta VDC. Altogether, 400 face-to-face household interviews were conducted and household questionnaire forms were filled up. Data required for the ecosystem service assessment were also collected.

Training on high-value agro-forest product promotion: The purpose of this training was to diversify household income by supporting high-value agro-forest production. Altogether thirty economically vulnerable households were selected through a discussion with the community. A training event was organised for these community members in May 2015. The participants got knowledge and techniques for sorting seeds, nursery establishment for seedlings and saplings, cultivating plot and soil preparation and treatment, plantation of seedlings and saplings, treatment of organic fertilisers and pesticides, irrigation supply, treatment of diseases and disorders, harvesting, and marketing. After the completion of the training, each participant was provided with some material support.

Training on home garden: The research supported the preparation and use of compost fertilisers (bio-fertilisers) and bio-pesticides and grey water management in 2015. Compost fertilisers were prepared applying pit method using raw materials, namely, green fodders, green leaves of local plants such as Banmara (*Ageratina adenophora*), Dhatura (*Datura stramonium*) and Asuro (*Justicia adhatoda*), livestock urine, kitchen biodegradable wastes, etc. Bio-pesticides were prepared using the raw materials such as green leaves of Asuro (*Justicia adhatoda*), Titepati (*Artemisiadubia*), Khirra (*Holarrhena pubescens*), and livestock urine.

4.4.3 Issue based interactions with experts

In addition to regular training and interactions, the research also organised some expert-community interaction events based on the need of the communities. For example, farmers in the research area developed some misconceptions. They thought that the restriction on open grazing in the community reduces the fertility of their goats. Similarly, households using ICS also believed that the improved stove took more time in cooking food compared to the traditional one. To discuss these issues and clarify from the technical perspective, an interaction meeting was organised at Sana Kisan Lower Secondary School, Punware, Rauta. Forty-five leading goat-rearing farmers from DAW CFUG attended the interaction event where a livestock technician from District Livestock Service Office and an ICS technician from Energy and Environment Section, District Development Committee shared their views. They clarified on the issues raised by the community.

Factors for influencing capacity-building process

Among many influencing factors, the skill and the ability of the research team to communicate was considered very important. Communication is generally related to skills of listening, speaking, and questioning. The study found that the research had attempted to establish better communication with beneficiaries and stakeholders considering these aspects. The research staff was mindful to listen well during various events (such as workshops, trainings, and various interactions with stakeholders) and was careful and attentive to understand local situations and local views. The research also emphasised the provision of clear message or 'speaking'. Interaction with communities and research staff revealed that the research staff had good ability to express themselves objectively and accurately to avoid confusions. As some facilitators were from local areas, it was easy to understand for the local community.

Photo 3: Participatory context analysis



Participants drawing resource map of Rauta VDC

Probably the most important aspect in action learning is the ability to question. And in this case, there was a mixed observation on the performance of the research staff. There existed two types of learning questions. The first one is the single-loop learning approach which questioned the cause and effect relations of the variables that would provide an opportunity to improve performance of intervention through minor adjustment of variables (time and substance). Whereas, the double-loop learning approach primarily raised questions on the basic assumptions and underlying causes of the research objectives and selected interventions. Both types of learning questions are important, but the research seemed to be mostly relying on the single-loop learning approach. The analysis showed that the questioning process had helped to raise awareness, get feedback, and identify the cause of the problems. But there were some room to improve by changing the perspectives and underlying assumptions related to the research and its interventions by using the second-loop learning approach.

The capacity-building process has also brought some results in the communities. The level of capacity building of women CFUG was one example. The DAW CFUGs received the district, national, as well as international awards for conservation and protection of their environment (Box 3).

Box 3: A woman member from DAWCFUG is receiving a national award



"It was so overwhelming and encouraging to be awarded in national level program that also by the honorable minister. We have already received award with cash prize and appreciation letter for managing our forest and natural ecosystem from District Forest Office, Udaypur. We are motivated to work more and we have proven that continuous small efforts for the protection of environment definitely bring the change" says Kumari Ale, the chairperson of *Dumrithumka* community forest user group. On the occasion of

World Environment Day 2016, Government of Nepal recognized the efforts being done by the women's group for the conservation of environment and awarded them with an appreciation letter and a cash award of NRs 25,000. These women are now more dedicated to the conservation works and feel proud to be awarded on such a big platform.

4.5 Step V: Implementing the Piloting Interventions

The research used four technologies for piloting and they are briefly described below.

4.5.1 Baseline creation

After the objectives and associated criteria and indicators were finalised, the research carried out a baseline⁴ study from the relevant sites selected for the specific actions. The overall objective of baseline creation was to create the baseline data on various aspects and indicators by explicitly defining the paradigm of changes of status and functions of ecosystems and livelihood within the four action researches. The indicators included both socio-economic and ecological attributes. For the baseline creation, five major study methods were employed. They included: stakeholder interaction, household survey, key informant interview (KII), field inventory, and review of secondary information. Both primary and secondary data were collected.

The research collected both socio-economic and biophysical data, which are described below. The following processes were followed while developing baselines in this research.

⁴ Baseline is a point of reference of the value or condition against which all future measurements will be compared. The baseline provides a starting point of a change situation to be monitored using parameters or sign post to the issues identified.

Socio-economic data: Data were collected through focus group discussions and household surveys. Focus group discussions were carried out at community level, whereas some standard questionnaires were developed for household survey. The collected data concerned details about demography, education, economic activity, well being, resource use, nature of consumption (e.g., of vegetables), the seasonal variation and rate of consumption of fuel wood, time spent on fuel wood collection, and various other information related to livelihood. It is, however, noted that the existing sampling frame and sample size (e.g., for ICS survey) did not ensure the required level of scientific rigour.

Biophysical data: The research established grazing ‘treatment’ and ‘control’ observation plots in the community forests. Baseline information was collected before and after grazing control at different intervals. The research carried out a field inventory to collect data from the sample plots within community forests (Photo 4). Biodiversity indicators were identified, such as plant diversity, canopy cover estimation, ground cover estimation, forest growth estimation, and faunal variety.

4.5.2 Planning

The planning entails developing plausible action plans for effective implementation. In this case, there were two types of planning. The first one was action research technical planning and the second was planning for implementation with local communities and stakeholders.

Action research planning: The first type of planning was related to articulating and developing an action plan to test the four selected technologies at the local level, while considering the technical quality and standard of action research. The process also included developing research questions and hypotheses for the proposed interventions, evaluating what types of knowledge was required, and determining which conceptual frameworks were useful for easy data collection and analysis. The analysis showed that the research used some aspects of the planning (see above concept note in diagnosis part), but the efforts were not adequate as per the proper goals of action research planning.

For this, a robust research protocol is needed, which considers the technical quality and scientific rigour. Generally, the protocol may include background information and justification, clear objectives of the research, research questions and hypotheses, approaches and methods for the research (facilitating change), data collection instruments and data collection process, as well as specific deliverables (outputs) and expected outcomes (Box 4).

Planning for implementation

In the second stage, a collaborative planning process for implementation of action research is required that clearly identifies the roles and responsibility of the participants. The planning supports research officials and local communities to develop a concrete and robust yet implementable strategy that can translate the research protocol and plan into actions. This enables research participants to know what they would do, and when, how, and with what resources (human and financial). It should also include quality assurance mechanism by having a participatory monitoring and evaluation plan.

Photo 4: Leaf litter collection for weighing



Box 4: Action Research Protocol

- Topic/issue:
- Background and rationale:
- Objective/s:
- Approach:
- Research questions:
- Research outputs:
- Brief theory of change including risks and assumptions:
- Expected outcomes:
- Data collection methods/process:

The research adopted this process to layout the role and responsibility of stakeholders, but there was not adequate information available to see that the planning for implementation was adequately carried out to reflect the important issues of roles and responsibility of actors with time and financial resources. From the discussion, the following points were considered important for planning for implementation:

- Clear roles and responsibilities of stakeholders with time and resources;
- Identification of critical assumptions, risk analysis, and risk mitigation measures;
- Review of the interest, power relation, and ability of stakeholders;
- Inclusion of relevant and diverse stakeholders and/or their representatives;
- Provision for stakeholders to share information with their constituencies; and
- Feedback from relevant stakeholders to validate the plan.

4.5.3 Implementing the planned actions

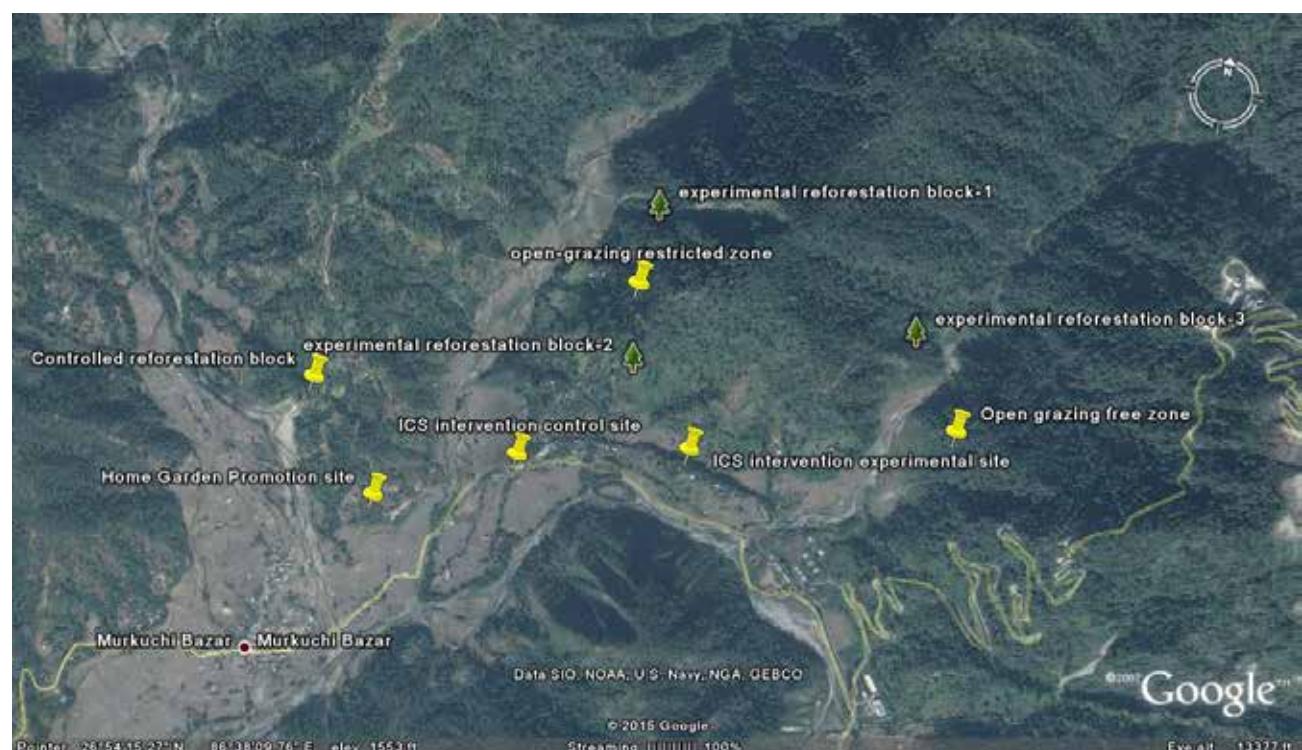
The main objective of this stage was to ensure that the planned activities were implemented and to solve the challenges as they emerged during implementation. There were no major challenges encountered during implementation phase, so the research managed the implementation phase quite efficiently. The research mobilised local communities for various activities, and it was also noticed during the field visit that various community groups were formed to assist implementation smoothly.

There were four main interventions:

- Controlled grazing plot for degraded forest regrowth,
- Improved Cook Stove (ICS),
- Reforestation of landslide prone area, and
- Promotion of kitchen garden.

These activities were implemented in various part of the Rauta VDC and the overview of the implementation sites is shown in Map 2.

Map 2: Aerial map of location of activities implemented



Management of controlled grazing plot for degraded forest regrowth

The grazing restricted plot (experimental plot) was established at Karambisauna while free open grazing plot (control plot) was established at forest under authority of Udayapur Cement Factory at Sukaura, Japla-Chilaune VDC. The sites were selected purposively. The main objective of this action research was to transform barren land caused by soil erosion into vegetational land. Specific objectives were: to sensitise and inform the local people on factors, effects, and control of soil erosion; to control soil erosion through plantation; to generate alternative income for the CFUG; and to supply fodder and firewood for the community users.

Management of ICS

The research supported 47 households (treatment community) bordering the DAW CFUG to use ICS from the communities. The treatment community was selected mainly to reduce the fuel wood extraction from the DAW CFUG, whereas control site was chosen from another community. The main objective of this action research was to curtail the pressure on the forest for fuel wood collection. Although there were some adoption challenges in the beginning, the users later on appreciated the benefits from ICS.

Support on home garden

Twenty-four households in Khanitar, Rauta, Ward Number 9 were selected for the action research. The households were selected based on their interest and activeness in the community. The main objective of this action research was to utilise the barren land and the areas surrounding the houses, whereas specific objectives were: to sensitise and inform the local people on home gardening; to promote agro-forestry; to generate alternative income; and to provide fodder and firewood. The research was supported with vegetable seeds and fruit samplings. The participating farmers also received training support and other regular technical support for growing vegetables. Important trainings received by farmers included production of compost fertiliser (bio-fertilizer), preparation and use of bio-pesticides, and management of grey water.

Reforestation of soil erosion area

Three erosion-prone areas located in Rauta VDC, Ward Number 5 were chosen as reforestation sites for soil restoration, also labelled as experimental plots. These areas were locally known as Ratopani, Dahan, and Chhyarchhyare, and they were considered as different blocks. Similarly, three control plots without any intervention were established near the landslide at Laxmi CFUG located in Rauta VDC, Ward Number 9. The main objective of this action research was to transform the barren land caused by soil erosion into vegetational land. The specific objectives were: to sensitise and inform the local people on factors, effects, and control of soil erosion; to control soil erosion through plantation; to generate alternative income for the CFUG; and to supply fodder and firewood for the community users.

4.5.4 Collaborating with relevant stakeholders

The research maintained a very good relation with district line agencies, mainly with District Forest Office (DFO), District Soil Conservation Office (DSCO), District Agriculture Development Office (DADO), and District Livestock Service Office (DLSO). These offices were involved in providing some thematic input in the selection of research sites and technologies. They also provided other regular forms of technical support. In addition, they also participated in exposure visits, training workshops (as trainers), and joint monitoring visits (Box 5). Some of the organisations even extended their support through their own funding in order to facilitate the action learning process in the sites. For instance, DFO provided saplings of bay leaves and trainings for bio-briquette production to the research area community. Similarly, DSCO provided plant saplings, and DADO supplied vegetables seeds along with technical and financial support to small scale commercial agriculture in the community. It was also noted that the research planned to collaborate with DADO for livestock dung management (*bhakaro sudhar*) programme in 106 households in the research area covering Wards 5 and 9 in Rauta VDC. District Development Committee Udayapur also supported by organising refresher trainings on ICS construction to two youths from the communities. The study showed that the collaborative work between the government line agencies, local government, and the research was instrumental in encouraging community members to actively participate in the research activities.

Box 5: Joint monitoring

One day joint monitoring to access and evaluate the progress of undergoing action research at

Dumrithumka Adarsh Women CFUG was organized on March 17, 2015. Nine representatives from; line agencies (District Forest office, District Soil Conservation Office and District Agriculture Development Office); District Development Committee, Village Development Committee, FECOFUN; and local news reporters (including Chairman of Federation of Nepalese Journalists) at Udayapur participated along with representatives from implementing partner (Nawaprabhat Nepal and BCN) as well as members of CFUG and lead farmers from the community.



In summary, the research very effectively managed its activities. The analysis showed that there were some critical factors that assisted in effective management of the research activities. The first one was experienced human resources. As the concept of climate change and ecosystems services are new discourses and are evolving continuously, professionals with good knowledge of climate change and ecosystems management were key to the good management of the action research. The research also felt some general challenges in terms of inadequate knowledge, skill, and ability during the early stage of research implementation. However, this gap was addressed by providing training and continuous mentoring support to field staff by professional staff from ICIMOD and BCN. This indicated that the human resource capacity gap had to be considered during the planning phase.

Another important factor for smooth implementation was related to clear roles and responsibilities between the partners and local level stakeholders. In absence of clear roles and responsibilities, nobody would be responsible and accountable to accomplish the targeted activities and ensure the quality of work. In addition, the flexibility of research activities and implementation modality were equally important in responding to changing contexts, knowledge and need. This was highly important for this kind of research where there was inadequate knowledge and where research modalities were evolving. The research maintained flexibility and pursued adaptive management systems so that there were no major issues while implementing the research.

4.6 Step VI: Monitoring, Evaluation and Learning (MEL) and Documentation of Learning

4.6.1 Monitoring, evaluation and learning (MEL)

Regular monitoring, periodic evaluation, and learning are central to assess the progress of the research and to identify the challenges and opportunities. These processes also provide an opportunity to adjust existing activities and integrate new ones. As this research was an action learning research, a continuous practice of monitoring, evaluation, and learning is needed to ensure proper reflection and gather lessons.

The research primarily used a participatory approach in monitoring, periodic assessment, and learning. In these processes, proposed activities and targets were checked whether they were implemented or delivered as per the plan and reviewed whether they were progressing well against the proposed research outputs and objectives. According to the research staff, regular monitoring events helped to improve the quality implementation and also to upgrade knowledge and skill of communities to manage research activities. These types of internal assessments provided opportunities for self-reflection and to identify correction measures. Reluctant members or stakeholders could also have a chance to raise their voice and participate in the programme, and the process enhanced the overall sense of local-level ownership over the action research.

The research carried out MEL functions by involving stakeholders from local, district, and national levels. At the research sites, the monitoring was carried out both through formal and informal processes. For the formal process, the community members and research staff met regularly (typically on a bimonthly basis), and they discussed the progress made and challenges encountered thus far. Based on this, whenever necessary, they also changed their plan of action. Aside from this, the community members and the research staff also interacted in numerous unplanned, informal ways.

At the district level, the research team invited relevant district-level stakeholders to interact with the communities in a regular basis. Experts from Kathmandu as well as districtlevel officials visited the sites as a part of the joint monitoring trips (Box 6). In addition to regular discussions on the progress of the research and challenges faced by communities and the research team, these visits also addressed discursive issues of the research concerning climate change and ecosystems management. These types of meetings generally provided an overall picture of the research and how the initiative can be sustained in the long term. The action research employed participatory approaches and established a quasi-experimental design to assess the disaggregated results achieved. In terms of measuring success and ensuring accountability and learning, a broader results framework has been developed as a result of the research and a greater range of implementing partners have been identified. Implementing partners have reported of the progress of the action research, based on the timelines agreed upon in the LoA. Thus, the MEL functions focused more on the short-term management of the research rather than on its long-term objectives.

The action research adopted a participatory planning, monitoring and evaluation mechanism and embedded it into the research model from the very beginning. However, discussions with partners and desk review of the research documents reveal that the 'long-term' nature of results for such ecological and environmental action research was not considered from the beginning of the intervention. ICIMOD and partners expected to achieve action research results which were 'long-term' within a shorter span of three years. Looking at the project implementation period, the MEL function and action research team should have come-up with short-term results. They could have built upon the short-term results and planned accordingly for desired long-term results.

In order to achieve desired results, the action research followed a formal mechanism of results-oriented planning, and identified implementing partners and government agencies as boundary partners for better implementation on the ground. These partners, including professionals from ICIMOD, participated in joint monitoring and real time evaluation missions to the research site.

ICIMOD established a quasi-experimental design for the research by identifying experimental and control plots as well as communities. Following the evaluation design, baseline, mid-line, and, end-line studies were conducted. The baseline and mid-line results have been shared with relevant stakeholders, and a draft end-line report is under review at ICIMOD.

Box 6: Local level joint monitoring process and achievement

One of the positive points of this research was monitoring activities from the members of ICIMOD, BCN, district line departments including other stakeholders. It helped to build up synergy and pulling of resources from the government line departments such as support for construction of local irrigation channel by District Soil Conservation Office, bio-briquette preparation training for the local people and Bay leaf saplings (1000) and fodder forage saplings distribution (supported by District Forest Office) and also cattle shed improvement (100 shed improvement supported by DADO). These all activities were possible through regular joint monitoring activities which build up a strong relationship with the district line departments and their involvement from the very beginning of the research implementation. It also boosted the morale of the research farmers as they were motivated when their work was appreciated by the line agencies and on the spot, solution to the problems by the experts during the monitoring.

4.6.2 Documentation of evidences and learning

One of the major objectives of the action research was to draw learning from the research for own use as well as for sharing lessons with a wider body of stakeholders. Documentation of the research findings and learnings were, hence, important to enhance the understanding of ecosystems-based adaptation in the face of climate change. In addition, proper documentation was also useful to exhibit how, why, and to what extent the methods, tools, and processes were useful to deliver results. It is not adequate to just mention that an approach works or does not work. Organisations interested in this kind of action research may want to know detailed processes and how an approach performs in a specific context. They may also want to know the challenges faced, possible cost and benefits of those processes, and what lessons can be drawn to share with other stakeholders. All these questions can be answered through a systematic documentation of research processes at different phases of the research cycle.

The research came up with a comprehensive documentation on the status and interdependence of ecosystems and people of the study area. It was, however, noticed that there were some rooms to improve in documentation processes of the findings and learnings from the research. The analysis showed that there were many themes and components in this research representing socio-economic and ecological aspects and they needed a systematic documentation.

Evidence collection can be gathered either from participatory or quantitative methods. In case of a participatory approach, qualitative data are collected, analysed and compared. It is also important to collect information that have intended and unintended, direct and indirect cost and benefits. Quantitative methods can follow some scientifically rigorous practice. As discussed in the research design section, the research can produce evidence by using quasi-experimental approaches. The research had created 'control' and 'treatment' in order to avoid various types of biases. But the research could also use 'before' and 'after' comparisons. These comparisons can be done by using baseline data and the data gathered after the completion of a research (endline).

5. Major Learnings and Areas for Improvement

The research was implemented for about two and half years. Despite the short duration of the research implementation, the research managed to follow some logical stepwise processes and was successful in clarifying some lessons. The review also provided some areas for improvement.

5.1 Major Learnings

While planning and implementing the research, there were also some good lessons that could be useful in the future. These learning are summarised below (Table 1).

Table 1: Major lessons from the action learning

Research cycle	Learning
Research design	Research design is the most critical stage for ensuring research quality and standards of the research. As this research deals with ecosystems-based adaptation along with people's livelihood, selecting a robust research methodology, considering local context, reflecting regularly, and building mechanisms for improvement have to be adequately integrated into the design itself. In addition, consideration of long time frame of action research with methodological rigour (such as having both qualitative and quantitative data) will provide a higher chance of getting more reliable evidences. It is important to consider the complex nature of ecosystems management process.
Preparation for the research	The research used vulnerability to climate change at district level as an index and the VDC was selected based on participatory climate risk assessment. Detailed baseline of research activities, ecosystems risk assessment, and longer term climate change vulnerability assessment provide technically high quality research in order to identify the practical solutions for participatory ecosystems management. In addition, the role of facilitation (listening, speaking, and questioning abilities) by the research team is instrumental to earn trust from the local communities.
Diagnosis of local context and finalisation of research actions (participatory inquiry and baseline collection)	Trade-off between ecosystems and livelihood priorities can be a challenge in some cases. A participatory process through a meaningful involvement of communities and stakeholders may, however, help in reducing this tension substantially. The research used participatory process to understand local situations and negotiate the expectations of the communities. This participatory processes was useful in increasing the synergy between ecosystems management and people's livelihood.
Capacity building: awareness raising, training, and exposure visits	Baselines data were collected during the research. The research gathered biophysical data from the sampled plots from the selected community forests, but it is important to collect both biophysical and socio-economic data so that data are statistically justifiable and can be compared (such as by using 'before and after' and 'with and without' methods). In addition, participatory methods such as baseline photos/videos and case studies would also be useful for comparing the situations and clarifying the context.
Implementing the piloting interventions	One of the major barriers in carrying out action research in ecosystems management sector is the inadequate capacity of research staff and community members. The research invested a lot of time and resources into this. A good mix of awareness raising and technical training are useful to increase knowledge, skills, and ability of the participants whereas exposure visits provide another dimension of capacity building through a 'seeing and believing' approach. The exposure visit was found a game changer in this research.
Monitoring, Evaluation and Learning; and documentation of evidences of change	Managing activities in real world situations is challenging. Negotiations between local needs and technical requirements of the action research are always expected. In addition, the research has to work on knowledge deficit context with diverse interests of the stakeholders. In such cases, the research may need to adopt flexible adaptive management approach with the stakeholders. In addition, a critical gaze at the ongoing implementation progress through continuous questioning, reflection, and improvement during the research implementation is important for better management of the research. The research had adopted participatory monitoring processes. A systematic approach to integrating Monitoring, Evaluation & Learning (MEL) with clear performance indicators is required, from research design to implementation. In addition, the short-term and long-term objectives of the research need to be identified in the beginning of the research design and they have to be reflected in the implementation plan. Similarly, the documentation of major learnings can be started from the early stage of the research design.

5.2 Main Driving Factors for Positive Change

The research has demonstrated some positive changes while implementing the action research. Some of the important driving factors for this achievement can be attributed to the following strategies:

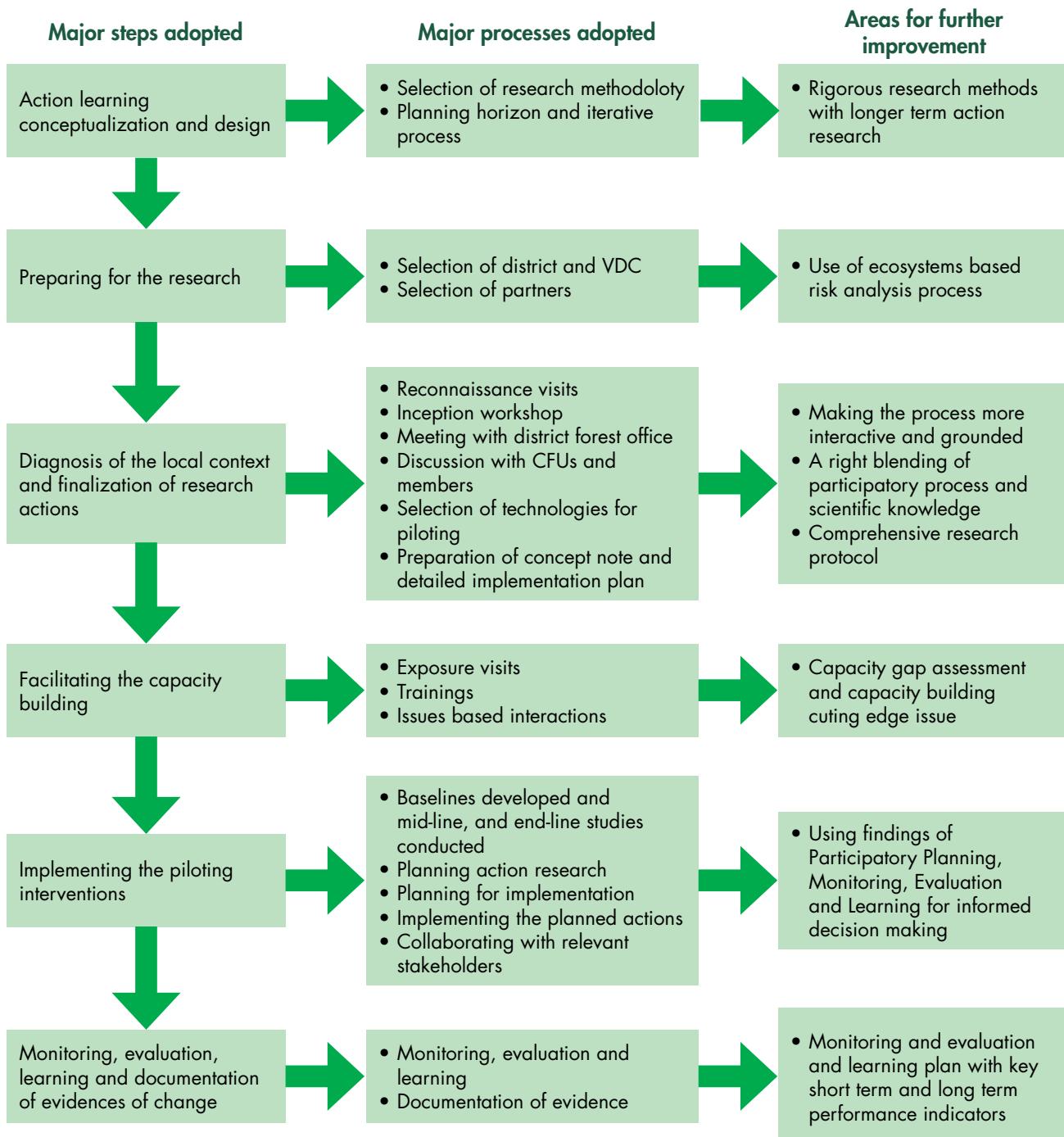
- The research emphasised capacity building activities for communities for their meaningful participation. Among them, exposure visits were found to be the most appreciated by the local communities. Generally, community members do not have opportunities to go out of their village and observe directly what other people are doing in other districts. In this case, one-on-one discussions with other innovative farmers or farmers' groups and direct field observations during the field visits were instrumental to increase their awareness and confidence related to the research activities. This was one of the main reasons why the involved communities took additional leadership on the research activities.
- The research also managed on-board district line agencies from the very beginning of the research planning. The close collaboration and networking with these agencies helped to ensure their support on technical as well as financial matters. Those organisations also participated in the joint monitoring visits, and hence there was a good coordination, understanding, and support among the research team, communities, and district line agencies. This was also one of the main influencing factors for the successful implementation of the research.
- In addition, the sustained technical support from ICIMOD in bringing national and international learning was instrumental in developing concept notes, planning research activities, organising exposure visits, providing feedback during review and joint monitoring visits, and mentoring research staff.

5.3 Areas for Improvement

Based on the interactions with various stakeholders, field visits, and analysis of the available data, the following points are important to consider for future action researches (Figure 3).

- A research methodology that incorporates stronger statistical options and considers the local context in a more thorough way has to be developed from the very beginning of the research design and appropriate human resources have to be put in place for the management of the research.
- Given the complex nature of ecosystems management, it is highly important to consider the drivers of ecosystem change. This includes climate change, which would provide more opportunities and threats of ecosystems management in research areas.
- A clear research protocol (technical detail of research) with clear roles and responsibilities of research participants are required for effective management of action research.
- Learning focused monitoring and evaluation has to be considered from the research design phase. While the participatory process is highly valuable, systematic periodic assessments provide validity and credibility to the findings for evidence-based decision-making.

Figure 3: Major steps, processes, and areas to be strengthened in the future



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