PROCEEDINGS

EbA Kathmandu Conference-III

28 September 2022

Organized by

रिसोर्सेस हिमालय

RESOURCES HIMALAYA

IUCN

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Conference at a Glance

The concept of ecosystem-based adaptation (EbA) was first introduced by the International Union for Conservation of Nature (IUCN) in 2008 and has gained importance since it was officially defined by the Convention on Biological Diversity (CBD) in 2009. Ever since, the concept has been embraced by intergovernmental and non-governmental organizations worldwide to promote adaptation policies and strategies and implement adaptation actions to help people adapt to the impacts of climate change. The EbA is nested with the concept of nature-based solutions for building the climate resilience of socio-ecological systems. Considering it, the UN Climate Action Summit in 2019 highlighted nature-based solutions for climate and sustainable development.

The EbA pilot project was initiated in Nepal, Peru, and Uganda in 2011 for four years with the support fund of the German Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU) and was jointly implemented by the United Nations Environmental Programme (UNEP), United Nations Development Programme (UNDP), and International Union for the Conservation of Nature (IUCN). In order to strengthen the national capacities to implement EbA options and reduce the vulnerability of communities, with particular emphasis on mountain ecosystems, the pilot project was implemented in the Panchase area of Kaski district in Nepal, Nor-Yauyos Cochas in Peru, and Mt. Elgon in Uganda. Similarly, to reduce the vulnerability of local communities, the GEF-funded EbA South project, entitled "Enhancing Capacity, Knowledge, and Technology Support to Build Climate Resilience of Vulnerable Developing Countries," was implemented in 2013 in three districts (Lamjung, Gorkha, and Tanahu) of Nepal. Furthermore, EbA-II and Urban EbA (2019-2022) are being implemented in recent years.

Since the inception of EbA projects in Nepal, IUCN Nepal, the Central Department of Environmental Science, Tribhuvan University (CDES-TU), and the Resources Himalaya Foundation (RHF) have actively been engaged in the research of EbA interventions, and its trainings, policy dialogues, and advocacy. IUCN Nepal implemented one of its flagship EbA projects in Nepal, "Scaling Up Ecosystem-based Adaptation in Mountain Areas Programme" (2017–2020), funded by BMU to expand EbA work in Nepal’s Himalayas. This project was aimed at improving the climate resilience of vulnerable communities and ecosystems in the Gandaki River Basin (GRB), expanding on ecosystem management, biodiversity restoration and enhancement, and natural resource management in the region, which currently comprises 19.3 percent of the country's population and more than 40 ethnic groups. IUCN Nepal has also been implementing a project called "Improving Climate Resilience of Vulnerable Communities and Ecosystems in the Gandaki River Basin, Nepal" (2020–2028), funded by the Green Climate Fund (GCF). The project adopts an ecosystem-centered and community-based approach to strengthen the climate resilience of ecosystems to reduce the impacts of landslides and floods.

In partnership with government and non-government organizations, CDES-TU, RHF, and IUCN Nepal have been organizing the EbA Kathmandu Conference to share knowledge and experiences. The first EbA Kathmandu Conference took place in 2016; the second will take place in 2021. This year (2022), the EbA Kathmandu Conference is proposed for September 28. MICD of Mid-West University, Agriculture and Forestry University, and local organizations such as Machhapuchhre Development Organization, Langtang Area Conservation Concern Society, and Rasuwa have also joined the endeavor.

Aim

EbA Kathmandu Conference III aspires to provide a platform to share EbA knowledge and experience gained from the EbA pilot projects and other such EbA activities, as well as discuss the practical implication of EbA in mitigating the effects of climate change and promoting environmental conservation.

Specific Purpose

- Exchange information about the implementation of EbA interventions and monitoring.
- Get feedback from stakeholders regarding the prioritization of EbA interventions and ascertain their relevance and role in terms of how they can support and contribute to the national goal.

- Establish future working relations to ensure that EbA interventions are understood and implemented effectively.

Conference Theme: Nature-based Solutions for Sustainable Development (2022)

Thematic Areas

- Mountain and forest ecosystems
- Agricultural ecosystem
- River and wetland ecosystems
- Urban ecosystem

Management Modality

The four sessions of the conference included an opening ceremony, technical sessions, and a valedictory session. To manage and organize the conference, organizing committees consisting of the Advisory Committee, a Scientific and Technical Committee, and a Management Committee were formed. The Advisory Committee guided the conference. Similarly, the Scientific and Technical Committee reviewed the manuscripts and presentations of fellow presenters and provided feedback. The management team coordinated with all these committees and took care of the logistics for the conference.

Expectations

The key speakers were invited from the national and international arenas. This was an opportunity to interact and learn about EbA interventions and practices from various experts.

- Learned from good practices demonstrated across the world in EbA
- Promoted network with relevant stakeholders in the field
- Published abstracts and articles in the symposia book

Conference Participants

The EbA Kathmandu-III conference was open to all interested young researchers who had conducted their research in EbA. The conference invited representatives from national and international organizations and stakeholders working in EbA. Guest speakers and key participants, including policy and decision-makers, planners, and practitioners, were expected at the conference.

Advisory Committee

Prof. Dr. Balram Bhatta, Dean, FOF-AFU

Prof. Dr. Chhatra Mani Sharma, Head of the Department, CDES-TU

Dr. Narendra Babu Man Pradhan, Program Coordinator, IUCN-Nepal

Scientific and Technical Committee

Dr. Ramesh Sapkota, CDES-TU

Dr. Ramji Bogati, FSHT-NOU

Ms. Anu Adhikari, IUCN-Nepal

Dr. Achyut Tiwari, CDB-TU

Dr. Meena Bohara, EGH-RHF

Management Committee

Coordinator: Dr. Gauri Shankar Bhandari, RHF

Mr. Daya Raj Subedi, MICD-MU

Mr. Hari Bol Acharya, Amrit Campus-TU

Ms. Neva Chaudhary, RHF

Registration

Application for abstract submission and registration were announced and the presenting papers were selected as per the themes and paper quality by the Scientific and Technical Committee.

Venue

Hotel Himalaya, Lalitpur, Nepal

Contact

Conference Secretariat

Resources Himalaya Foundation, RHF

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EbA KATHMANDU CONFERENCE III-2022

28 September 2022

Program Schedule

Time	Activity
08:30	Registration Tea/Coffee and Breakfast
09:00	**Opening Session** **Welcome note:** Session Chair Pragya Dr. Dinesh Raj Bhuju, Chair, RHF **Opening address:** Chief Guest: Prof. Dr. Shilu Manandhar-Bajracharya, Vice-Chancellor, NOU **Featured talk:** Professor Emeritus Dr. Ram Prasad Chaudhary, Tribhuvan University **Brief remarks** • Dr. Narendra Babu Man Pradhan, Program Coordinator, IUCN • Prof. Dr. Chhatra Mani Sharma, Head of Department, CDES- TU • Dr. Buddhi Sagar Poudel, Chief of Climate Change Division, GON-MOFE
10:00	**Session I: EbA Research Sharing** Chair: Prof. Dr. Kedar Rijal, CDES-TU Moderator: Dr. Nani Sujakhu, Yunnan University Presentations
11:30	**Session II: EbA Research Sharing** Chair: Prof. Dr. Balram Bhatta, Dean, FoF-AFU Moderator: Dr. Ramdevi Tachamo Shah, KU Presentations
13:00	Lunch
14:00	**Panel Discussion: Incorporating EbA Knowledge in Policy Formulation** • Mr. Gaurishankar Timala, Former DG, DOF-MOFE • Dr. Bimala Devkota, Senior Scientist, NCCKMC-NAST • Mr. Yalamber Rai, UNDP • Mr. Dil Bahadur Bhattarai, BOD, MDO Pokhara Discussion Facilitator: Dr. Meena Bohara, NOU
15:30	**Valedictory Remark: Way Forward** Dr. Usha Jha, Former Member of National Planning Commission Session Facilitation and Vote of Thanks: Ms. Anu Adhikari, IUCN
16:00	**Tea/Coffee**

Rapporteurs: Mr. Daya Raj Subedi, Ms. Sheila Ghimire

OPENING SESSION

Welcome Note

Vice-Chancellor of NOU Professor Shilu Manandhar-Bajracharya is the chief guest of the program. Professor Emeritus Ram Prasad Chaudhary is today's invited speaker and featured speaker. Professor Chhatra Mani Sharma, HOD at CDES-TU Dr. Buddi Sagar Poudel, Chief of Climate Division at MOFE Dr. Narendra Babu Man Pradhan, Program Coordinator of IUCN Nepal Invited scholars, professors, researchers, ladies, and gentlemen.

Humanity is living in a climate emergency where climate change should be significantly mitigated; additionally, greater efforts should be made to adapt to it. It does not need to be elaborated upon further. The outcome of climate change is the result of human greed, not human need. We are organizing this conference, not because we like it. I wish we did not gather here for such a cause at all, simply because climate change is not our interest but our profound compulsion. We are taking part in climate change because its impending impacts are of grave concern for us, especially for our future generations, who have no role at all in accumulating the huge amount of carbon dioxide, which is 1.5 trillion tons, since the era of the industrial revolution, for which they are not responsible. Unfortunately, this huge green house will remain for another 200 years, even if you meet the Paris Agreement. This conference is an outcome of our submission to this bitter reality and our sense of responsibility towards it. Your participation is to show our solidarity in facing the imminent catastrophe. Thank you all.

Adaptation, or adapting to life in a changing climate, involves adjusting to the actual or expected future climate. As we are all aware, there are two approaches to adaptation: community-based adaptation (CbA) and ecosystem-based adaptation (EbA). Ecosystem-based adaptation makes use of ecosystems and biodiversity to help people adapt to the impacts of climate change.

It is only natural for us to put humans at the center. Adam Smith, the author of The Wealth of Nations, conceived human beings as selfish, exclusively concerned with self-love, and having an unquenchable desire for the most extravagant forms of material wealth. Let’s imagine that all human beings are protected from the fallout of climate change. Are we the only living creatures affected by climate change? Aren’t the pollinating bees not affected? If yes, who will pollinate our three-quarters of food in their absence? It will be the height of absurdity for men to ignore their roles. And there are myriads of such species in the ecosystem. Then we need to save the whole ecosystem by adhering to its real sentiment. Let's recall that an ecosystem is a structural and functional unit where the living organisms interact with each other and the surrounding environment. Man is just a member of this system, not its master.

The Conference of Parties realized the importance of EbA in 2008. It was at COP 14 in Poznan, after over a decade of advocacy for adaptation. No wonder. It took over 100 years to adopt climate change at the policy level since Swedish scientist Arrhenius predicted global warming in 1896. Nepal was among the three countries to implement the EbA pilot project in mountain ecosystems. It was in 2012. In fact, Nepal has over six decades of scientific discourse on mountain ecosystems. In 1956, Jiro Kawakita had a warmth index diagram of six altitudinal forest types; in 1960, Hark Gurung proposed seven physiographic divisions and 50–55 ecological divisions. Numata created six life zones and a climax species description in 1966. The classification of 35 forest types under 5 phytogeographic regions by JDA Stainton is still a very popular classification. It was in 1976 (46 years ago) that Tirtha Shrestha and Pushpa Ratna Shakya, with their doctoral advisor Dobremez, brought a total of 136 ecosystems, which are now clumped into 118 and sometimes 60.

The practice of EbA is still long. We have been planting reeds (narkat, Phragmatis) in the banks of Bishnumati for time immemorial. Current knowledge justifies it as a kind of EbA or NBS. We have many more such practices in EbA. Mixed farming techniques to maintain soil fertility and conserve water; slow-forming terrace farming systems to increase soil moisture and reduce runoff.

The phrase "knowledge is power" is often attributed to Francis Bacon, the 16th-century empiricist. Still an ancient wisdom is *Dhiyo Viswa Birajati*, Knowledge rules the universe, the theme of NAST. Knowledge regarding this phenomenon helps people understand and tackle the consequences of global warming, encourages them to change their behavior, and helps them adapt to what is already a global emergency. This conference is to create a milieu for exchanging and enriching our knowledge on EbA and further finding out avenues of knowledge exploration.
Welcome to all

Table: 1 Studies in ecosystem in Nepal

YEAR	RESEARCHER	CONTRIBUTION
1956	J Kawakita (Japan)	Warmth index diagram of 6 altitudinal forest types
1957	U Schweinfurtch (Switzerland)	8 vertical zonation
1960	H Gurung (Nepal)	7 physiographic divisions; 50-55 ecological divisions
1960	T Hagen (Switzerland)	6 physiographic divisions
1966	M Numata (Japan)	6 life zones, climax species description
1972	JDA Stainton (UK)/ TB Shrestha	35 forest types under 5 phytogeographic regions
1972, 1976	JF Dobremez (France)/ TB Shrestha, PR Shakya	189 vegetation types, 6 bio-climatic zones; 136 ecosystems (118 – 60)
1999-2004	D Bhuju et al	Ecological database of Chure (Siwalik) range in Nepal

Dinesh Raj Bhuju, PhD

Conference Chair, EbA Kathmandu Conference-III, 2022

Chair, Resources Himalaya Foundation

Opening Address

First of all, I would like to express my gratitude and thanks to the organizers, Central Department of Environmental Science, TU, Resources Himalaya Foundation, and International Union for Conservation of Nature (IUCN) for providing me this opportunity to share a few words on the third EbA Kathmandu Conference.

Being a student of management, the most I can do is express a few stray thoughts as a layman. But from another perspective, it may be highly rewarding because experts know the answers, but the need of the hour is to make a layman like me aware of, internalize, generate universal commitment, and more importantly, adopt and practice the right ways. That is what must be taken to the universal level.

As evidenced by the events of the last several years, notably in the year 2022, predictions of the worst effects of climate change occurring in 20 to 30 years are progressively proving to be overly optimistic. The northern hemisphere, that is, Europe, Canada, and the US, set new records on temperature, not only making lives difficult but also triggering unwanted situations like wild forest fires in France and Spain apart from California, where they happen more regularly, and in Australia in 2020; unprecedented floods and inundation in Pakistan and Italy; and drought in China. These are only a few examples, but almost anyone on this planet now has been experiencing the effects of climate change in their everyday lives. The vagaries of weather are more pronounced than ever before, and probably it is already too late, but if we do not act now, the future of the planet will be in the doldrums.

However, the readiness of humans to address the issue at best appears to be lethargic. The Trump administration withdrew the United States from the climate change pact, meaning that we will continue to be slaves of political diabolism. The convention to forge an agreement on the use of coal, one of the biggest pollutants and causes of rise in temperature, just a little while ago could not be called a success with the absence of two of the biggest coal polluters, China and Russia, and India; another large coal user refrained from making commitments. This all shows that despite the continuous efforts of many, including all of you, the real commitments appear to be shallow, and the ultimate effect will be on all of us without exception, particularly vulnerable people.

Hence, simple technical and technological breakthroughs and developments are not going to be adequate. They are necessary of course but the fundamental efforts should be geared towards changing and improving the way we live, our attitude and our real practices. All religions teach us to protect the planet, for environmental conservation and living a responsible life. Here, I would like to emphasize from Buddhism, though preaching are aplenty in all other religions too, to protect this mother earth, to conserve nature and resources, and live a sustainable life in a rightful way. If we simply become mindful to those precious teachings, a lot of our problems could have been mitigated. But greed, undesired passion and unmindful activities of humans is probably shortening the life of this planet exponentially. Hence, I believe, we must arrest and stop all these and lead a meaningful, mindful and responsible life to bequeath this planet to eternal generations. This is time, albeit late, as I have said earlier to take actions.

Particularly it is more important in a vulnerable country like Nepal because of its physical features, eco-system and booming economic activities around. The threat to our unique biodiversity including the gorgeous Himalayas in true sense is great. Vulnerable people in this impoverished country are going to be more precarious. In the backdrop, this deliberation to introduce ecosystem-based adaptation action, I believe, is going to be very useful, but it must lead to actions which are expected to rekindle hope.

With this note, I declare open this important conference. Thank you.

Prof. Dr Shilu Manandhar-Bajracharya
Vice-Chancellor, Nepal Open University

Featured Talk

Mainstreaming Ecosystem Based Adaptation into Development Planning Process in Nepal: From Science, Policy and Practices Perspectives

The ecosystem-based adaptation (EbA) is the focus of this EbA Kathmandu Conference-III held today (September 28, 2022/12 Ashoj 2079), which provides a platform to share EbA knowledge and experience as well as discuss the practical application of EbA in mitigating the effect of climate change and promoting environmental conservation in Nepal.

Like the economies of most developing countries, Nepal's economies depend largely on natural resources and ecosystem services. The capacity of the country's ecosystems to provide products and services to sectors of society is pressured by land use and climate change (LUCC). It is necessary to consider the vulnerability and role of ecosystems to extreme events to enhance sustainability in various sectors, including but not limited to agriculture, forestry, energy, and water. Therefore, adaptation is needed for different sectors of society that are facing the impacts of climate change today and in the future.

EbA involves scientists, policymakers (national, regional, and local governments), and practitioners such as local communities, NGOs, and the private sector in addressing pressures on ecosystem services, and managing ecosystems to increase the resilience of people. It is quite challenging to establish an efficient dialogue between scientists, decision-makers, and civil society, but necessary for EbA. The aim of today's talk is to present important contributions that are targeted at the stakeholders who can design and implement EbA. This featured talk is based on a review of literature by scientists, in particular Nepali scientists, who have contributed to the analysis of the EbA concept and its impact in Nepal.

The Convention on Biological Diversity describes ecosystem approach as *'a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way'*. Further, it recognizes that humans, with their cultural diversity, are an integral component of ecosystems (IIED, 2021). The EbA is considered as a "nature-based solution" that is significantly important in the context of climate change (e.g.

UNFCCC Paris Agreement, NDC-Nationally Determined Contributions, and NAP-National Adaptation Plan); and biodiversity conservation policies (e.g. CBD-Convention on Biological Diversity Strategic Plan 2011-2020, Aichi Targets) (FEBA, 2017). EbA also links traditional knowledge associated with biodiversity and ecosystem conservation approach aiming to sustainable socio-economic development as part of overall strategy for helping local communities adapt to risks and socks related to LUCC (FEBA, 2017).

The EbA concept in Nepal started at the beginning of the 21st century to implement the commitments made in the CBD and UNFCCC. The Government of Nepal prepared the National Adaptation Program of Action (NAPA) in 2010; reemphasized climate change issues in the Paris Agreement (2015); and developed two climate change-dedicated policies, namely the National Climate Change Policy (2011) and the Climate Change Policy (2019), supporting the implementation of different types of climate change adaptation. Major sustainability issues Nepal has been facing in EbA include the low priority given to mainstreaming and upscaling EbA into development planning in Nepal (Bhattarai et al., 2021; Karki et al., 2021); a lack of effective institutional mechanisms and governance; and inadequate budget provisions (Reid et al., 2016; Mills et al., 2020). EbA activities are implemented on a small scale and run for a short period, so they fail to demonstrate tangible impacts. Community-based adaptation (CbA) is an important initiative to improve the capacity of local institutions and communities to adapt to climate change (Karki et al., 2021).

The EbA comprises a multi-sectoral and multiscale approach that take into account the role played by ecosystem services in reducing the vulnerability of society to climate change. In Nepali scenario, we also include Disaster Risk Reduction (DRR) as an important issue to be considered in the perspective of EbA and LUCC. Important roles for scientists, policy makers & planners, and societies are briefly mentioned following Vignola et al. (2009).

The scientists contribute to: (i) quantify and value ecosystem services for human wellbeing by reducing the vulnerability of society; (ii) evaluate uncertainties using different climate scenarios and models; (iii) work at local scales by identifying the flow of ecosystem services relevant to the adaptation of society; (v) communicate results with policy makers as well as non-scientists including public administration and media in their own understandable languages; (vi) interact and closely work with local communities and private sectors in order to understand traditional processes of adaptation and ecosystem management, design EbA and implement; and (vii) interact with policy makers to ensure that results are communicated in a way that is relevant to policy-makers.

Similarly, national policy-makers contribute to the EbA process by: (i) mainstreaming adaptation and ecosystem services into national development policies considering multi-sectoral and cross sectoral approaches; (ii) developing/establishing innovative funding, such as payment for ecosystem services (PES) as well as international adaptation funding sources; (iii) strengthening the links between adaptation and mitigation and fostering synergy between them, such as REDD (Reduction of Emission from Deforestation and Forest Degradation) mechanism; (iv) interacting with local communities by making the indigenous peoples and local communities (IPLCs) knowledgeable about, capable of and responsible for EbA promotion including traditional ecological knowledge at the local level, and (v) interacting with scientists (both natural and social scientists) focusing on uncertainties inherent to climate change studies.

Finally, communities, local actors, private sector and civil society contribute to: (i) define and implement adaptation strategies for EbA as a part of their local resource planning by protecting their rights and values at the design of adaptation plan; (ii) reward ecosystem service providers that conserve and restore ecosystem services; (iii) interact with policy makers for means to empower the capacity of local actors; (iv) interact with scientists and inform them about observed temporal changes and local adaptation practices.

In conclusion, an increasing political commitment is needed to understand and implement the complex interactions between human and environmental systems for the conservation and management of ecosystem services. So, it is important that a variety of actors, such as scientists, policy-makers, and civil society, are actively involved in mainstreaming EbA into development planning process in accordance with their mandates in order to promote the role of ecosystem services in societal adaptation to climate change. Funding will also strengthen the understanding among policy makers and practitioners to qualify EbA process. To accomplish this, in some places, this may require "transformational approach" rather than "incremental approach" to adaptation.

I conclude my talk by saying what Fyodor Dostoevsky, a Russian Novelist in 1860s wrote that "every blade of grass, every insect, ant, and golden bee, all so amazingly know their path." But, it is pity that we human beings are the only element of nature that veers away from the path that nature prescribes, creating many problems for ourselves.

Thank you and Namaste!

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Professor Emeritus Dr. Ram Prasad Chaudhary
Tribhuvan University, Kirtipur, Nepal (ram.chaudhary53@gmail.com

Brief Remarks I:

Dr. Narendra Man Babu Pradhan
Program Coordinator, IUCN Nepal
Kupondole, Lalitpur

IUCN is a global membership-based organization which works with a people-centricframework focusingon land, water, and ocean. It implements a large and diverse portfolio of conservation and nature-based solution projects for the people. EbA was first started in Nepal, Peru and Uganda as a pilot project. IUCN has been involved in the EbA activities to develop methodology and identify the tool. During the first phase of EbA project, focus was directed towards, implementation, piloting, and adaption in policy. We have a practical example of the success of EbA in the Panchase region whose success story is popular worldwide. Now, moving towards the second phase, the focus has been shifted towardsscaling up the activities. Now, Gandaki River Basin Project is being initated through the application of experiences of EbA. I am very glad that IUCN is collaborated with RHF and CDES in this EbA conference, which I believe, is a knowledge hub where one can share about the understanding of EbA. By bringing young researchers together in one platform.

Brief Remarks II:

Prof. Dr, Chhatra Mani Sharma
Head of the Department,
Central Department of Environmental Science, Kirtipur

I have skeptical views on climate change because I believe that an evidence-based debate is required for any issues. Climate change has occurred, and the impact has been observed in many places around the world. There is no doubt that an ecosystem based approach is necessary to tackle the issues related to climate change but we should think about considering the microclimate as well. There should always be evidence-based debate for that continuous data collection is necessary. Research develops data and results, however, being a part of the scientific community we should question those outcomes as it enables us to think about the level of approach needed to tackle the issues. We have built a lot of knowledge on climate change but still need to search new knowledge. There are already directions which have been provided by previous EbA activities, but the concentration should be given in developing new evidence-based data so that new directions can be achieved.

Brief Remarks III:

Dr. Buddhi Sagar Poudel
Chief of Climate Change Management Division,
Ministry of Forests and Environment, Government of Nepal

We are all facing complex global problems regarding climate change. As it has been discussed, currently, we are facing triple planetary crisis: biodiversity loss, plastic pollution and climate change, but we are doing very less. Nepal has prepared a lot of policies and plans, so it is time for local level adaption. To understand the natural system of the country, ecosystem mapping is required because the severity of impacts varies according to the ecosystem. If we know the vulnerability of certain areas, we can adapt properly. There has been many programs being carried out by the government and a lot has been perceived about adaptation. Government has been working on integration of EbA into policy, application of Local Adaption Plan Action (LAPA) framework, and planning to devise policies and guidelines in the future. We are also preparing for COP27 with the main theme of “adaption”. We know that adaptation should be the top priority for Nepal, but the approach to it is still unclear due to the limitation in the long term database. So, there is a need for long term data, so that a stronger evidence based approach can be discussed to address the issues of climate change and compensate for the loss and damage.

PRESENTATIONS

Session I: EbA Research Sharing

Mountains as Cradles and Museums of Species Diversity: Ecological and Evolutionary Perspectives

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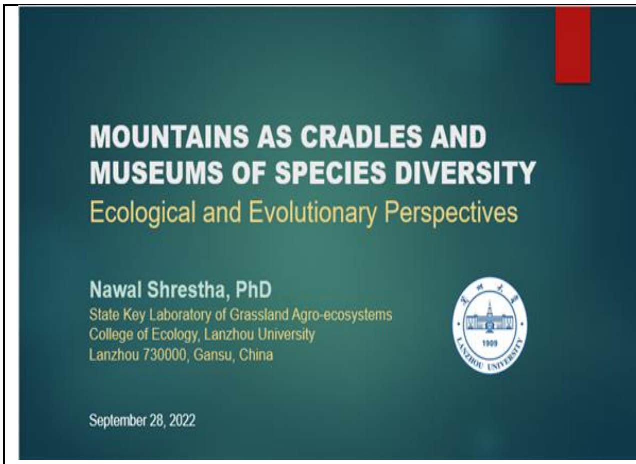
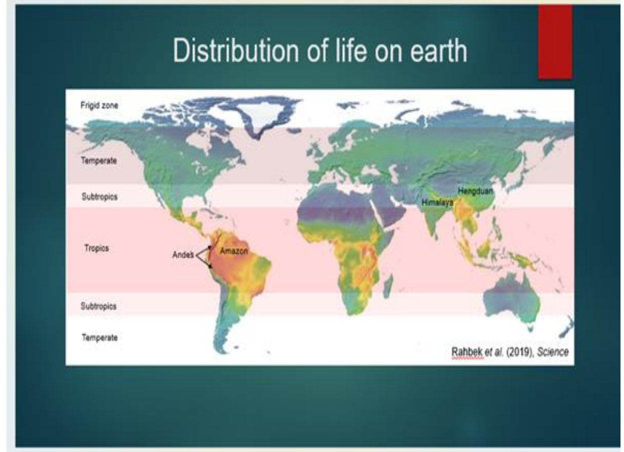
Abstract

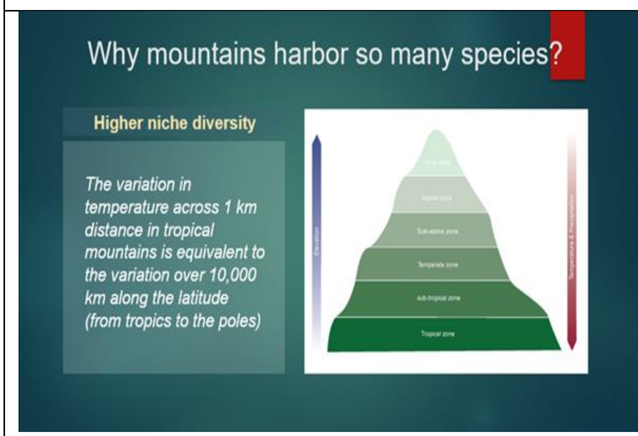
Mountains are key features of the Earth's surface and host a substantial proportion of the world's species. Mountains are one of the richest endemic centers (hotspots) for plants in the world. The high biodiversity in mountain can be attributed to high niche diversity therein due to great variation in temperature along the elevation gradient. Mountains also act as refugia (museum) during periods of climate change and hence prevent extinction of species. Furthermore, the thermal and physiological barriers in mountains provide enough opportunities for allopatric speciation (cradle) thereby providing impetus for the evolution of new species. In addition to offering biodiversity value, mountains also play an important role in providing a wide range of goods and services to humankind, such as freshwater resources, food, timber, energy, minerals, medicines, etc. Mountain biodiversity also acts as a support system for the global environment, controlling pollution and climate change. Despite high ecosystem and evolutionary values, mountains are facing increasing pressure from land conversion, development and climate change. The increased frequency of natural disasters, droughts, forest fires and change in the growing season are adding to the challenges of already marginalized mountain communities. Therefore, our current conservation/mitigation endeavors solely based on contemporary environment without understanding the signature of the past evolutionary processes seem ineffective. The foundation of how biodiversity forecasting of climate change is done, especially in mountains, is very weak and may need adequate understanding of the role of geology, climatology and evolution on mountain biodiversity and ecosystem.

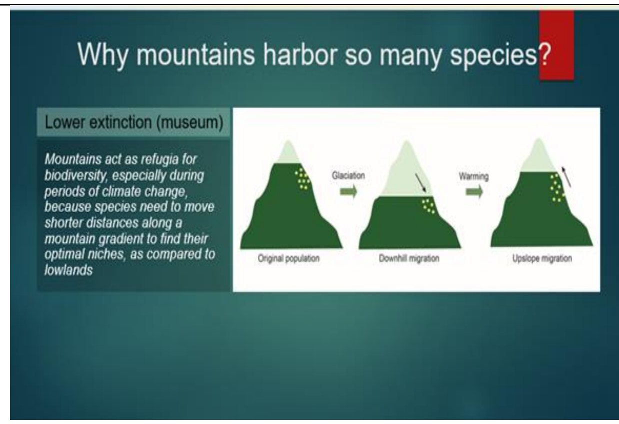
Keyword: Mountains, Endemic centers, Elevation Gradient, Allopatric

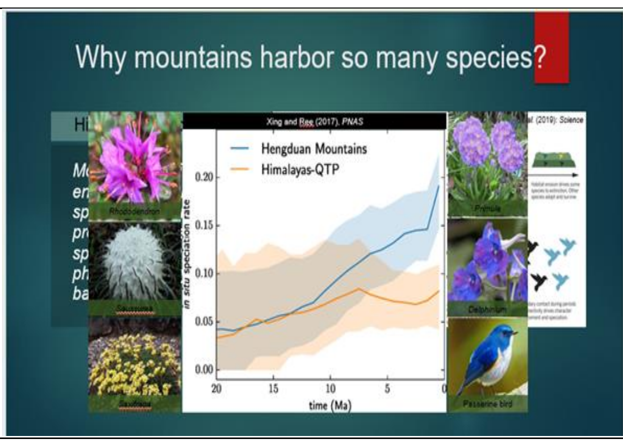
Nawal Shrestha

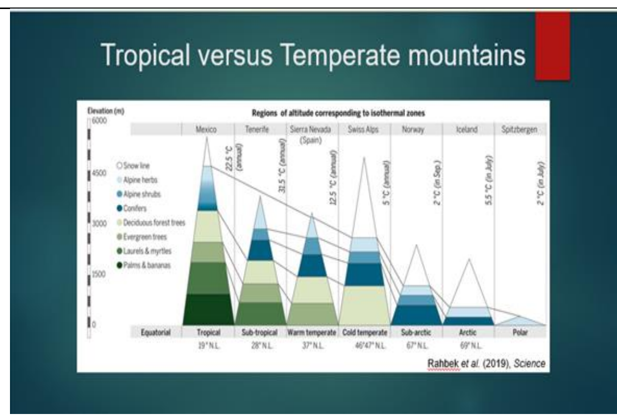


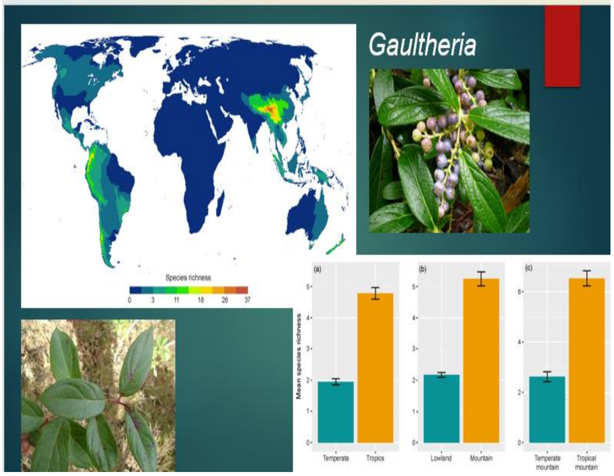


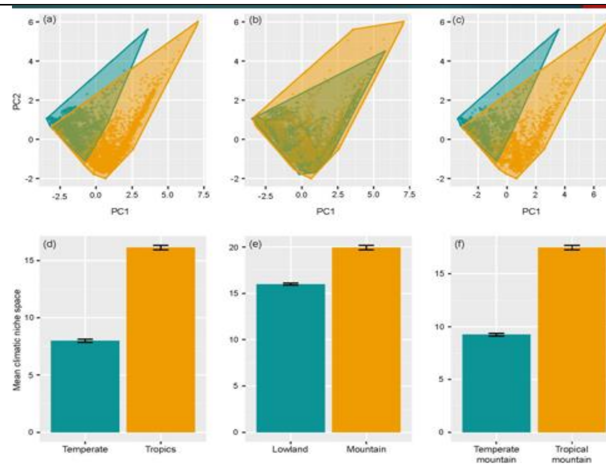


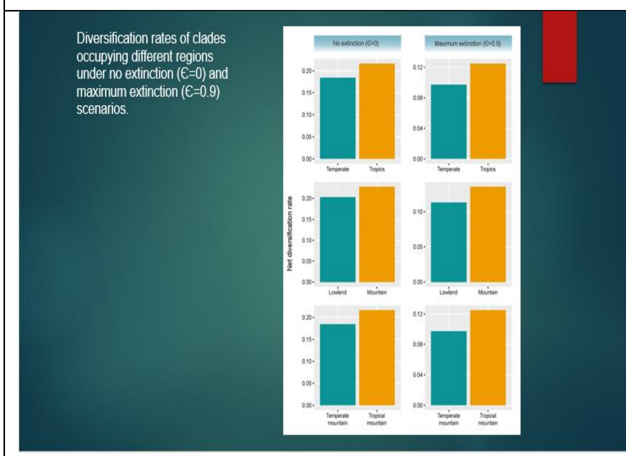


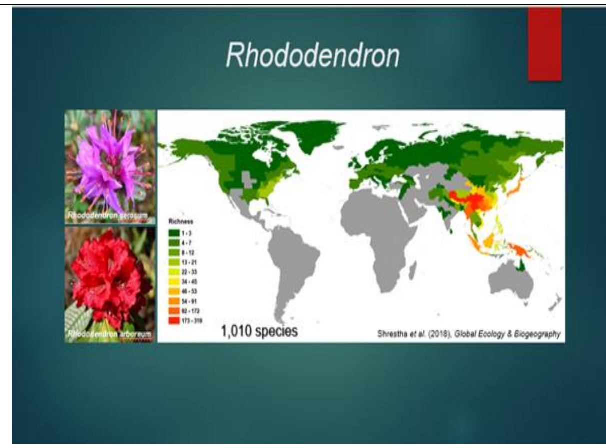


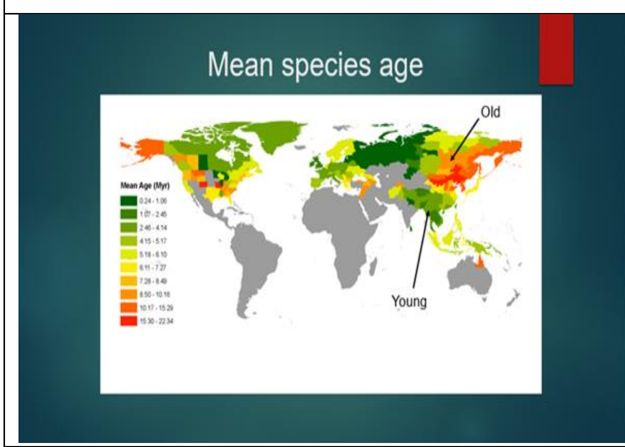


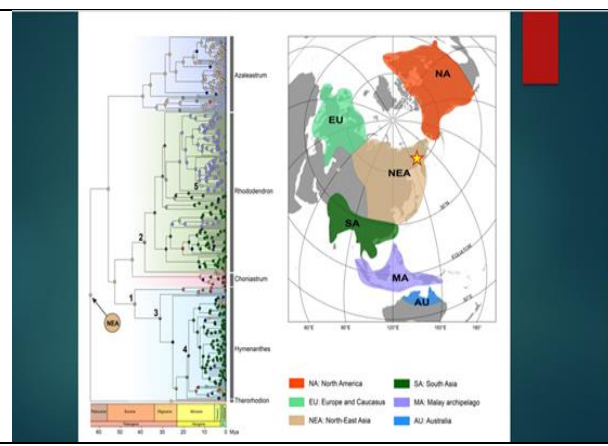

Gaultheria
Species richness
Mean species richness
Temperate
Tropics
Lowland
Mountain
Temperate mountain
Tropical mountain


PC1
PC2
Mean climatic niche space
Temperate
Tropics
Lowland
Mountain
Temperate mountain
Tropical mountain

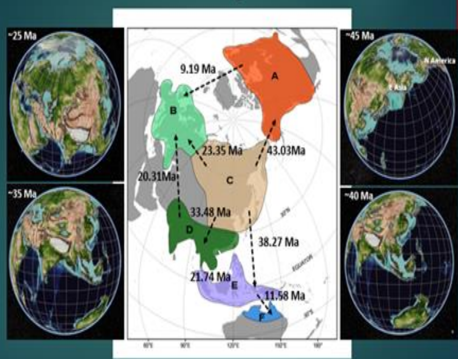

Diversification rates of clades occupying different regions under no extinction (Є=0) and maximum extinction (Є=0.9) scenarios.
Net diversification rate


Rhododendron
1,010 species
Shrestha et al. (2018), Global Ecology & Biogeography
Richness

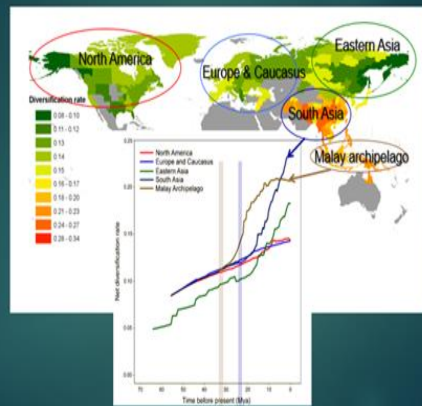

Mean species age
Old
Young
Mean Age (Myr)


NA
EU
NEA
SA
MA
AU
NA: North America
EU: Europe and Caucasus
NEA: North-East Asia
SA: South Asia
MA: Malay archipelago
AU: Australia

Possible dispersal route



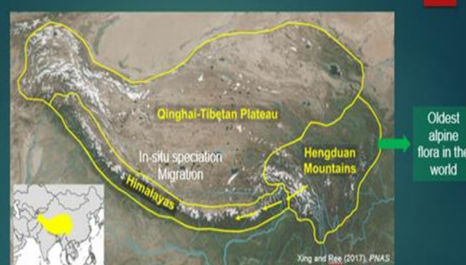
Spatial and temporal diversification



Multiple simultaneous Autoregressive (SAR) models of species diversity (Model 1) and mean diversification rate (Model 2) against the combination of energy, water, seasonality and habitat heterogeneity variables

	Energy (PC1)	Water (PC1)	Seasonality (PC1)	Habit heterogeneity (PC1)	Total explained R^2 (predictor + space)
Model 1					
SAR coeff.	-13.015	10.816	-11.509	**14.433**	0.70
P- value	0.021	0.056	0.051	<.001	
Model 2					
SAR coeff.	0.009	-0.002	-0.01	**0.013**	0.88
P-value	0.046	0.703	0.035	<.001	

Conservation insights



Mountains are evolutionary centers (cradle) and are perfect refugia (museum) for species' long-term persistence

Other services

- Mountain plays an important role in providing a wide range of goods and services such as freshwater resources, timber, energy, minerals, medicines, etc.
- Mountains also provide opportunities for recreation and spiritual renewal.
- Mountain biodiversity acts as a support system for the global environment, controlling pollution and climate change.
- At least half of the world's population depends on mountain ecosystem services to survive – not only water but also food and clean energy.

Challenges

- Mountains are facing increasing pressure from land conversion, development and climate change.
- Most mountain ecosystems are threatened by degradation and over-exploitation of resources, and highland ecosystems are witnessing the impacts of climate change, including range shifts.
- The increased frequency of water induced disasters, droughts, forest fires and change in the growing season are adding to the challenges of already marginalized mountain communities.


Way forward
Traditional approaches to predicting how species will react to warming might not work
The foundation of how we do biodiversity forecasting of climate change, especially in mountains, is probably on very shaky ground
Without understanding signature of the past evolutionary processes on extant biodiversity pattern, the efficiency of our conservation endeavors solely based on current environment is questionable
There is also a more pressing threat: development, in the form of new roads, hydroelectric dams, and growing settlements and farms

Biochar Effects on Crop Yield: A Smallholder Farm Study from Southern Plain of Nepal

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Abstract

Is a carbon-rich form of charcoal produced by burning organic waste in an oxygen-deprived Biochar chamber? If incorporated in soil, it builds overall soil health, increases crop yield, reduces chemicals' runoff and improves water holding capacity. A study was undertaken to know the effects of biochar in winter maize yield of the smallholder farms in Kuleni village, south-central Nepal. Biochar was prepared by using the locally available invasive plant *Lantana camara*. It was applied in four replicates of a factorial randomized field with five treatments (control, 5t/ha biochar, 5t/ha biochar+5t/ha Farm Yard Manure (FYM), 10t/ha biochar+10t/ha FYM, and only 15t/ha FYM). The measurements covered height, crown, and biomass and grain yield of the studied crop maize. A questionnaire survey was also carried out to understand the farmers' knowledge of biochar and their willingness to use it. The study revealed that all the measurements including yield varied widely among the treatments. The plots with the treatments of 10t/ha biochar+10t/ha FYM gave the highest yields of both biomass and grain, 17.4t/ha and 7.86 t/ha respectively, followed by the treatments of 15t/ha of FYM (13.9t/ha and 6.82t/ha). Similarly, the control plot had the lowest biomass and grain yield (10.4 t/ha and 4.04t/ha). From the survey, it was found that only 15% of farmers have used biochar in their farms. Among these farmers, 40% said that there was an increase in crop yield. Of the all interviewed farmers, 30% showed interest to use biochar. However, the farmers pointed out some challenges and difficulties such as the cost and time of producing biochar, health hazard and smoke during the biochar production. This study reveals that biochar, if mixed with compost, can significantly increase both biomass and grain yields. Additionally, making biochar from invasive species and agricultural waste can provide opportunities to convert the waste into a meaningful product. Long-term research involving diverse crops and larger farmland is recommended.

Keywords**:** *Biochar, Crop yield, Invasive species, Pyrolysis, Soil amendment*

Rita Thapa

BIOCHAR EFFECTS ON CROP YIELD: A SMALLHOLDER FARM STUDY FROM SOUTHERN PLAIN OF NEPAL

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Goldengate International College
Tribhuvan University Affiliate

Introduction

- Biochar is produced from the thermal degradation of organic material (agricultural byproducts and invasive plant species) in the absence or limited supply of oxygen (Woolf et. al., 2009).
- Biochar addition has shown positive effects on soil chemical properties in Nepal, with increased pH, CEC and organic carbon (Pandit et. al., 2017).
- The field of biochar is fast moving and properties are uniquely powerful case for pathways to meet the UN call for Sustainable Development Goals (SDGs), especially in lower and middle income countries (LMICs).

2

Rationale

- In Nepal, soils are often moderately acidic showing low nitrogen (N), phosphorous (P) and exchangeable base concentrations (Brown et al., 1999).
- Among the biggest challenges of the 21st century is the need to nearly double food production by 2050 while reducing the emissions of greenhouse gases in the atmosphere (SDGs 2 and 7).
- The strong need to focus on solving these grand challenges has sparked a global interest in large-scale production and the use of biochar.

3

Objectives

General objective

To assess the effectiveness of biochar prepared from invasive species *Lantana camara* on crop (maize) yield in smallholders' farm land.

Specific objectives

- To prepare biochar from invasive plant species (*Lantana camara*) and evaluate its quantity.
- To measure crop (maize) yield after treating the soil with biochar and selected amendments.
- To find out the local farmers' perception of biochar and its use in farmland.

Lantana camara. Wikipedia

4

Study Area

- Kuleni, Nawalpur, Nepal
- Geographic position: 27.32⁰N and 83.40⁰E; 151 masl
- Climatic condition: warmer climate, subtropical and temperate.
- People are dependent on agriculture and foreign remittance.

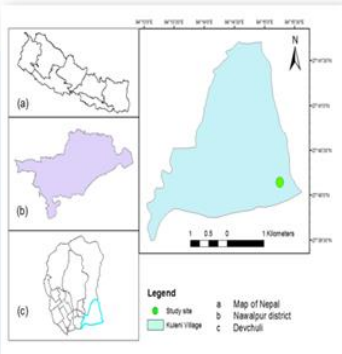


Fig. Study area map

5

Methods and Methodology...

1. Biochar production and evaluate its quantity

i. Feedstock was collected from nearby community forest and biochar was prepared by the process of pyrolysis.
ii. Before and after the preparation of biochar, the weight was taken.

2. Plot design and biochar application

i. Randomized factorial plot of $3*2m^2$ was designed.
ii. Biochar with compost was mixed in soil with different rate.

Biochar application rate

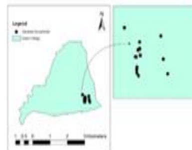
i. Control plot (no biochar and compost)
ii. 5ton/ha biochar
iii. 15ton/ha compost
iv. 5ton/ha biochar+5ton/ha compost
v. 10ton/ha biochar+10ton/ha compost

6

Methods and Methodology…

3. Maize sample and measurements

i. Maize seed were brought from nearby agro shop in Kuleni and sown distancing 20/20 cm each by row and column.
ii. In every 15 days the height and crown cover of plant was taken.
iii. For the productivity, the fresh and dry weight of 5 plants from each plot was taken (Dobermann, 2005).



4. Questionnaire survey

i. General Information
ii. Demography
iii. Agriculture
iv. Use of Biochar

DATA ANALYSIS

- Data were analyzed by using Microsoft office excel and R-programming software.
- Kruskal-Wallis test was used to analyze the significant differences between the selected study variables for plant productivity.

8

Result: Biochar Yield

- Biochar was prepared.
- Among the total 4 batches of biochar production, batch III has highest yield whereas batch IV has lowest yield.
- The amount of biochar depends on the amount of feedstock added, temperature of pyrolysis.

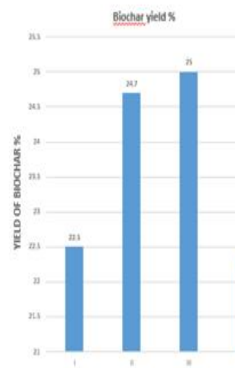


Fig: Biochar yield from *Lantana camera*

9

Result: Height of the Maize

- The highest mean height was observed in treatment 4 (10 ton biochar+10 ton compost) that is 150cm.
- The lowest mean height was observed in control plot (no biochar and no compost) which was 134cm.

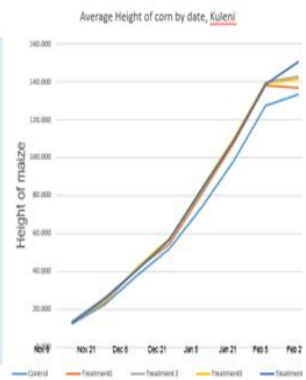


Fig: Height of Maize plant

10

Result: Crown Cover of Maize

- The results of crown covers are much varied than height the crop.
- The highest crown cover was observed in treatment 2 (15 ton compost) that is 55cm.
- The lowest crown cover was observed in control plot (no biochar and compost) that is 46cm.

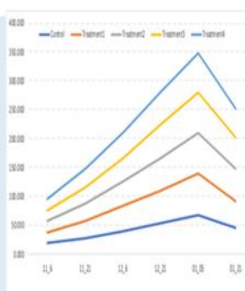


Fig: Crown cover of the maize plant

11

Result: Biomass Yield

- Highest total dry above ground biomass obtained of treatment 4 that is 17t/ha.
- The lowest biomass obtained of control plot that is 10t/ha.
- For the significant crop yield, long-term soil amendment with biochar might be required as reported by researchers such as Islami et al. (2011a), and Yamato et al., (2016) for maize.

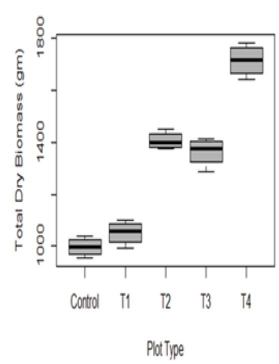


Fig: Dry biomass of the crop

12

Result: Grain Yield

- The highest grain yield obtained of treatment 4 that is 8t/ha.
- The lowest grain yield was obtained of control plot that is 4t/ha.
- Many previous studies demonstrated that biochar application increases crop yield by 10-20% (Blackwell et al., 2010).

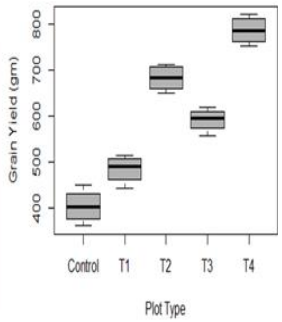


Fig: Grain yield of the crop

13

Result: Farmers' Perception on biochar

Biochar using farmers

- Total 15% farmers are using biochar in their farmland.
- Rest of the 86% of farmers do not use.

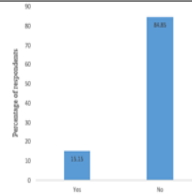


Fig: Biochar using farmers

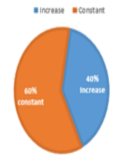


Fig: Productivity change of crops

Productivity Change of Crops

- Only 40% farmers stated that the productivity of crops has increased.
- Other 60% stated that there is no change in the productivity of the crops.

14

Result: Farmers' Perception on biochar

Challenges of Using Biochar

- Out of provided 5 options of the question challenges faced while using biochar, the third option that is, it creates health problems got highest percentage.
- The fourth one obtained the lowest views that is, it causes environmental problems.

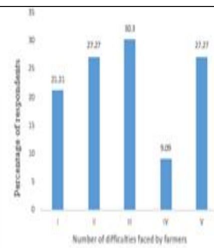


Fig: Difficulties/Challenges faced by farmers while using biochar

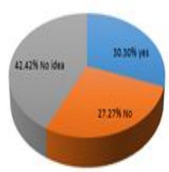


Fig: Percentage of people who will use biochar in the future or not

Willingness to use biochar

- Out of surveyed farmers 30% of surveyed farmers want to use biochar in the future whereas 27% of farmers don't want to use.
- Whereas 42% have no idea whether they will use it or not.

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Conclusions

- Biochar can be prepared by using locally available agricultural waste products, agricultural leftovers and invasive species.
- Using compost in field is a good practice but mixing it with biochar can be best.
- Farmers of study area are willing to use biochar if they are provided with subsidies by the government.

Recommendation

- Biochar can be used as a farmer's tool for increasing crop productivity and supporting government policies of agriculture production using available resources.
- Studies on effectiveness of biochar in pest control in farmland will help popularize use of biochar.
- Application of biochar in various other agriculture crops in different seasons involving smallholder farmers will give comparable results.

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Photographs

Assessing Problems and Prospects of Non-Timber Forest Products Development and Utilization (A case study of Rani, Khotena and Satti Community Forest User Groups of Kailali District)

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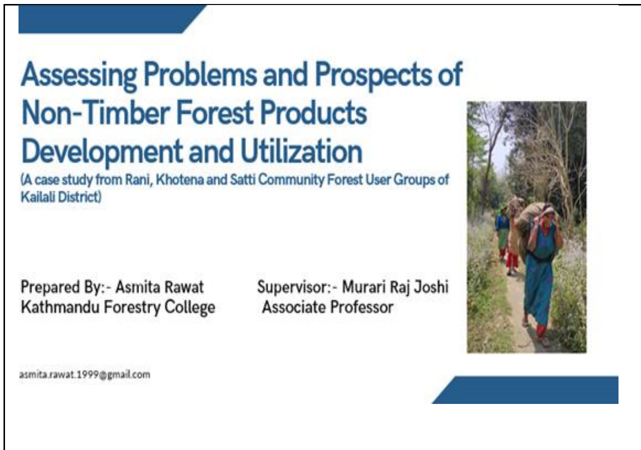
Abstract

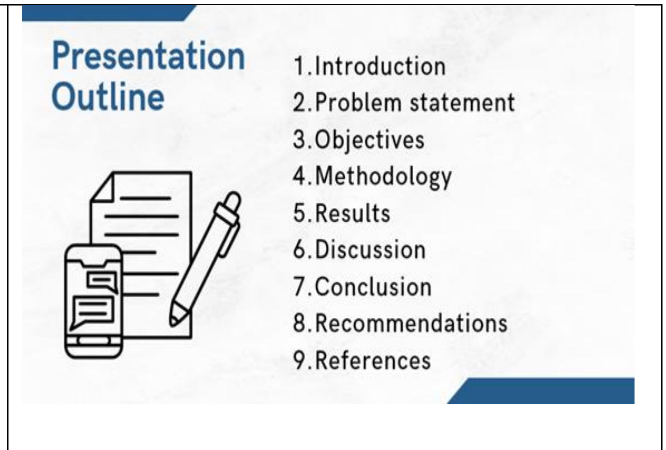
Non- Timber Forest Products are all goods and services derived from forests which include bamboo, rattan, dyes, wild foods, resin and others which are major source of livelihood support for local peoples. A study was conducted to determine the problems and prospects of NTFP development and utilization in Rani, Khotena and Satti community forest user groups of Tikapur municipality Kailali district. Both primary and secondary information was collected through questionnaire surveys, key informant discussion, focus group discussion, preference ranking and direct observation and review of literatures. Out of 380 respondents from three CFUGs, the participation of women was higher with 65.6% compared with men. Out of 31 NTFPs recorded in study areas, bamboo (*Bambusa vulgaris*) and rattan (*Calamus latifolius*) have contributed more on livelihood of CFUG members through income and employment opportunities. Majority (71%) of the total respondents reported that NTFPs collected from community forests and farmlands have also contributed on food and nutrition of CFUG members like Bamboo shoot (*Bambusa vulgaris*), Niguro (*Diplazium esculentum*), Mushroom (*Aquricus bisporus*), Amala (*Phyllanthus emblica*), Bel (*Aegle marmelos*), Bayar (*Ziziphus jujube*), Harro (*Terminaliachebul*a) and Barro (*Terminalaia bellerica*). The study also revealed the problems for NTFPs development and utilization in study CFUG areas which were limited knowledge of users on use of NTFPs, no focus from government on NTFP development and management, lack of marketing facilities, flooding in community forests during rainy season. While looking to the future prospects for NTFPs development and utilization in study areas, majority (92%) of the total respondents reported that Bamboo (*Bambusa vulgaris*), Rattan (*Calamus latifolius*), Bel (*Aegle maemelos*), Mushroom (*Aquricus bisporus*) and Amala (*Phyllanthus bisporus*) have

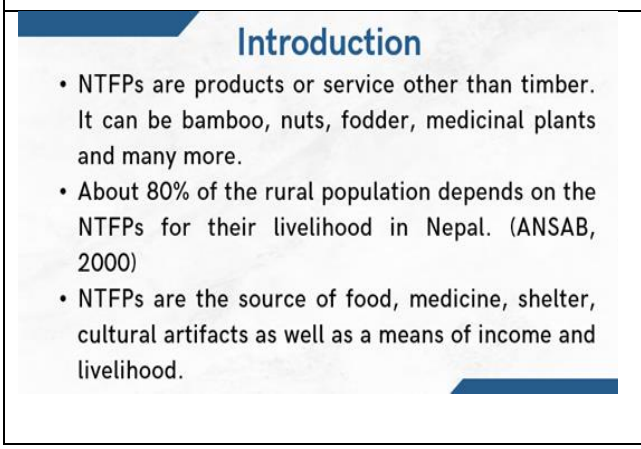
received higher priority for future development and management in study CFUG area. Finally, it is recommended that capacity building technical support should be provided to CFUG members for NTFPs development and utilization in study areas and community forest operational plans should also be revised giving emphasize on NTFPs development and management.

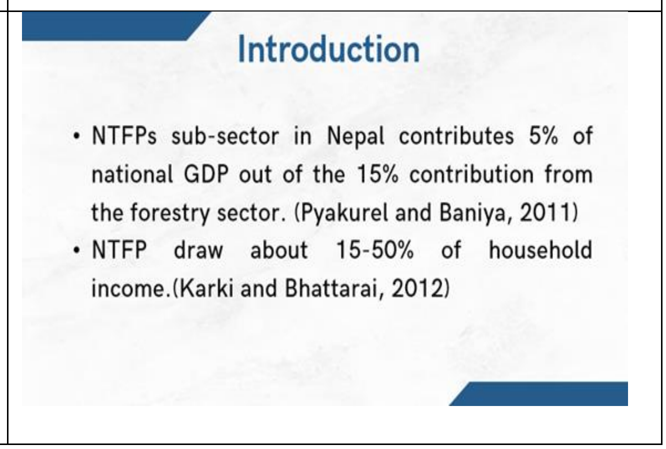
***Keywords*:** Community Forests, Community Forest User Groups, Non-Timber Forest Products, Livelihood, Problems, Prospects

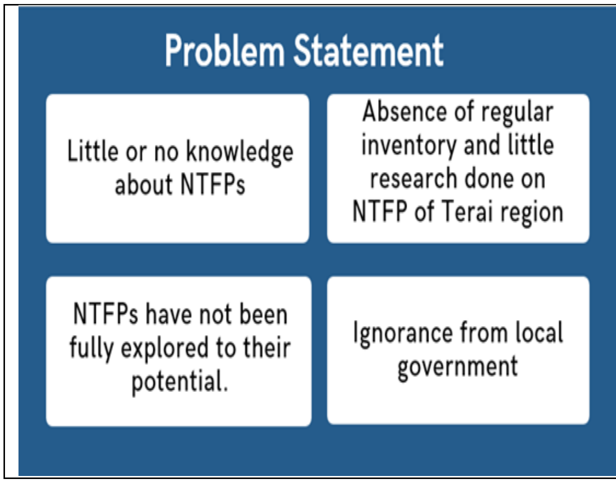
<u>Asmita Rawat</u>

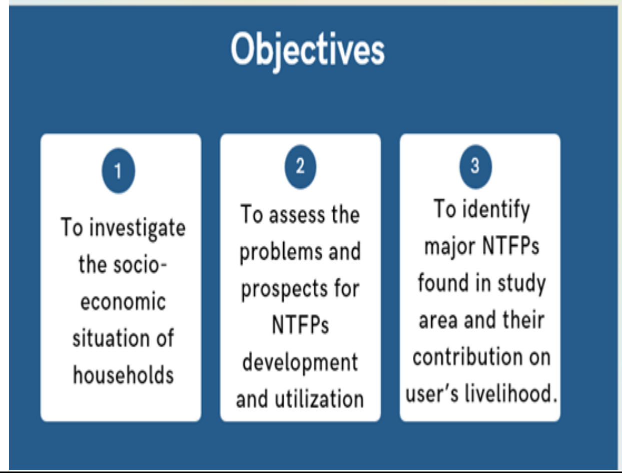


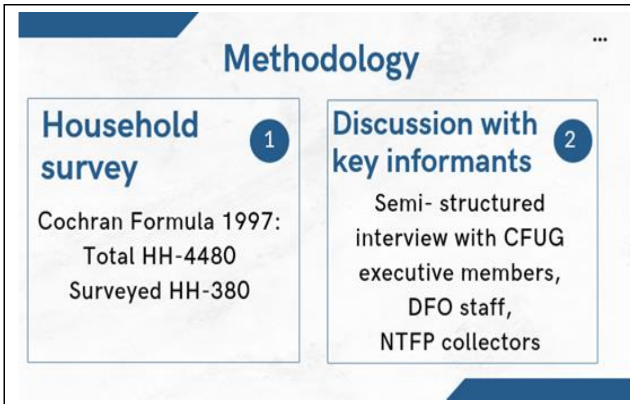


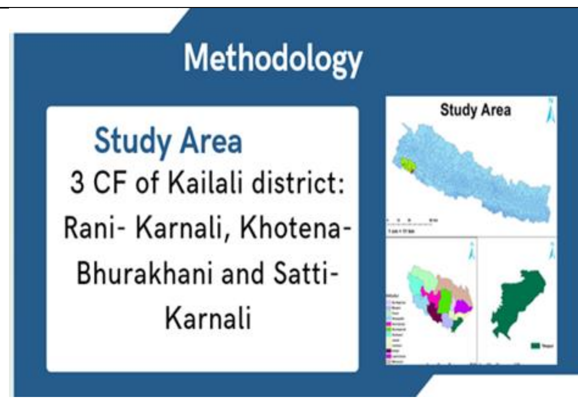


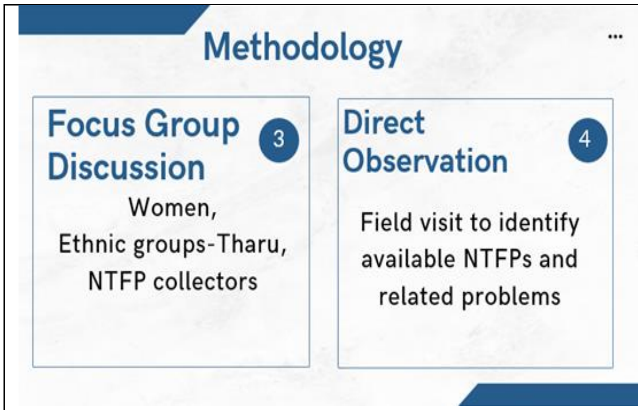


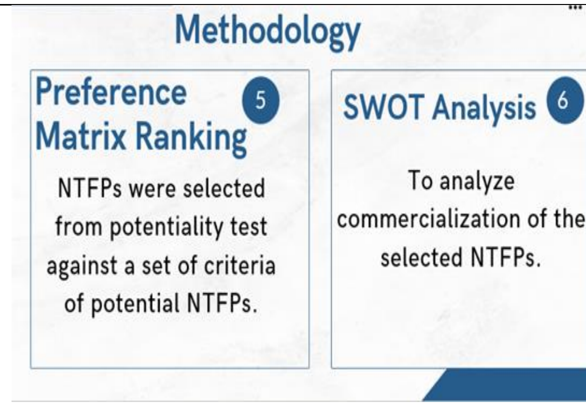

Problem Statement
Little or no knowledge about NTFPs
Absence of regular inventory and little research done on NTFP of Terai region
NTFPs have not been fully explored to their potential.
Ignorance from local government

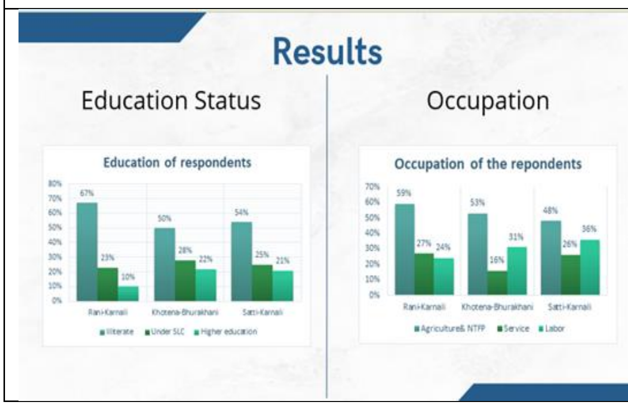

Objectives
1
To investigate the socio-economic situation of households
2
To assess the problems and prospects for NTFPs development and utilization
3
To identify major NTFPs found in study area and their contribution on user's livelihood.

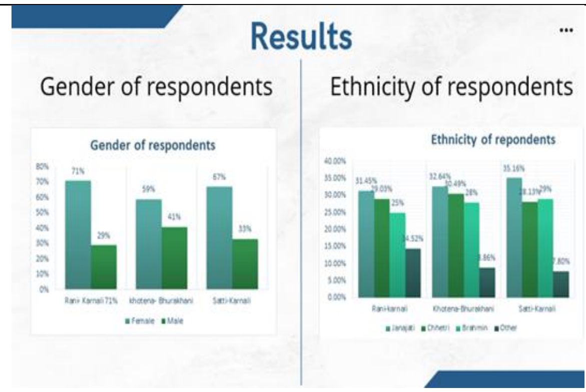

Methodology
Household survey
1
Cochran Formula 1997:
Total HH-4480
Surveyed HH-380
Discussion with key informants
2
Semi- structured interview with CFUG executive members,
DFO staff,
NTFP collectors

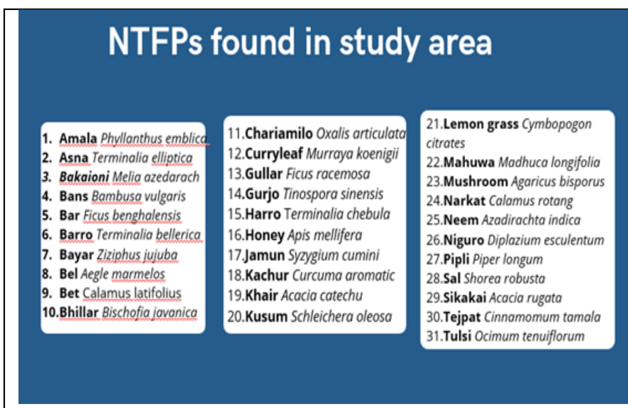

Methodology
Study Area
3 CF of Kailali district:
Rani- Karnali, Khotena-Bhurakhani and Satti-Karnali
Study Area

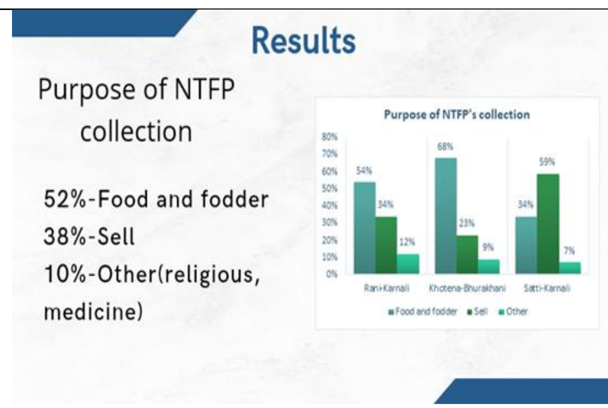

Methodology
Focus Group Discussion
3
Women,
Ethnic groups-Tharu,
NTFP collectors
Direct Observation
4
Field visit to identify available NTFPs and related problems

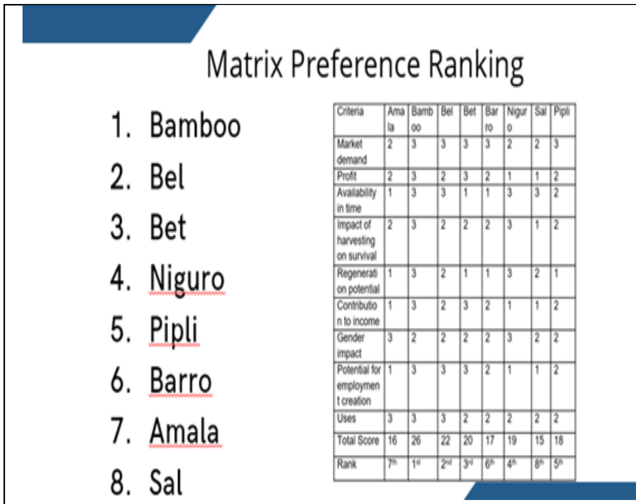

Methodology
Preference Matrix Ranking
5
NTFPs were selected from potentiality test against a set of criteria of potential NTFPs.
SWOT Analysis
6
To analyze commercialization of the selected NTFPs.


Results
Education Status
Occupation
Education of respondents
Rani-Karnali
Khotena-Bhurakhani
Satti-Karnali
Illiterate
Under SLC
Higher education
Occupation of the repondents
Agriculture& NTFP
Service
Labor

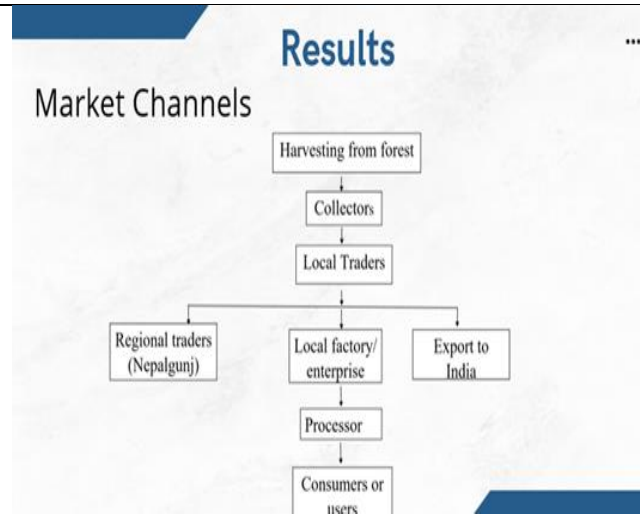

Results
Gender of respondents
Ethnicity of respondents
Gender of respondents
Female
Male
Ethnicity of repondents
Janajati
Chhetri
Brahmin
Other

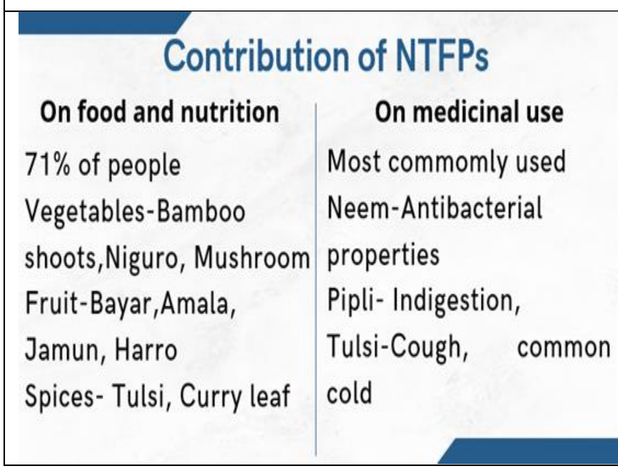

NTFPs found in study area
1. Amala Phyllanthus emblica
2. Asna Terminalia elliptica
3. Bakaioni Melia azedarach
4. Bans Bambusa vulgaris
5. Bar Ficus benghalensis
6. Barro Terminalia bellerica
7. Bayar Ziziphus jujuba
8. Bel Aegle marmelos
9. Bet Calamus latifolius
10.Bhillar Bischofia javanica
11.Chariamilo Oxalis articulata
12.Curryleaf Murraya koenigii
13.Gullar Ficus racemosa
14.Gurjo Tinospora sinensis
15.Harro Terminalia chebula
16.Honey Apis mellifera
17.Jamun Syzygium cumini
18.Kachur Curcuma aromatic
19.Khair Acacia catechu
20.Kusum Schleichera oleosa
21.Lemon grass Cymbopogon citrates
22.Mahuwa Madhuca longifolia
23.Mushroom Agaricus bisporus
24.Narkat Calamus rotang
25.Neem Azadirachta indica
26.Niguro Diplazium esculentum
27.Pipli Piper longum
28.Sal Shorea robusta
29.Sikakai Acacia rugata
30.Tejpat Cinnamomum tamala
31.Tulsi Ocimum tenuiflorum

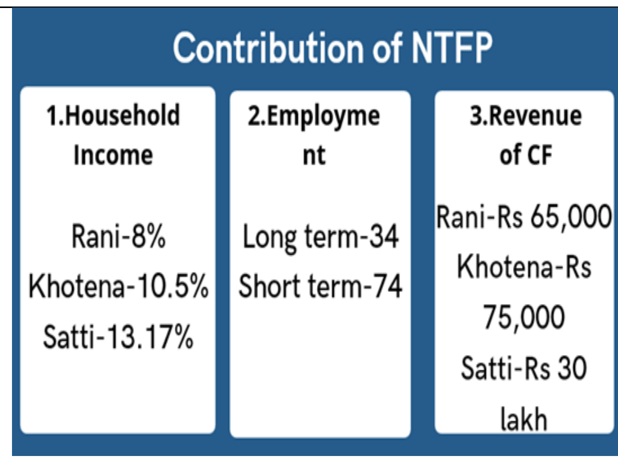

Results
Purpose of NTFP collection
52%-Food and fodder
38%-Sell
10%-Other(religious, medicine)
Purpose of NTFP's collection
Rani-Karnali
Khotena-Bhurakhani
Satti-Karnali
Food and fodder
Sell
Other

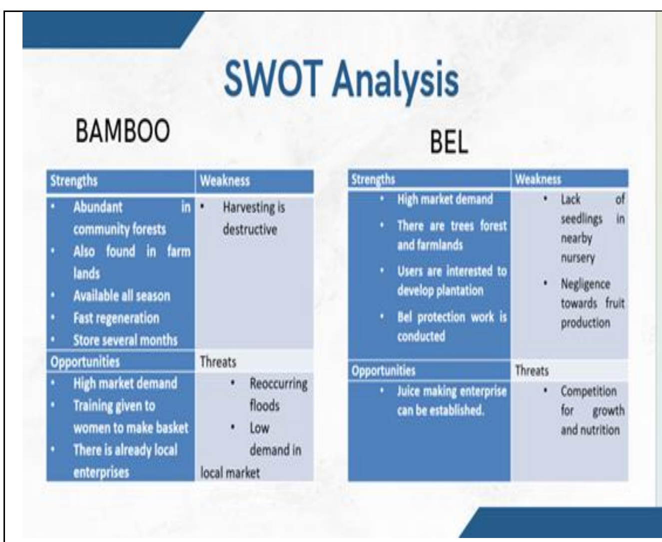


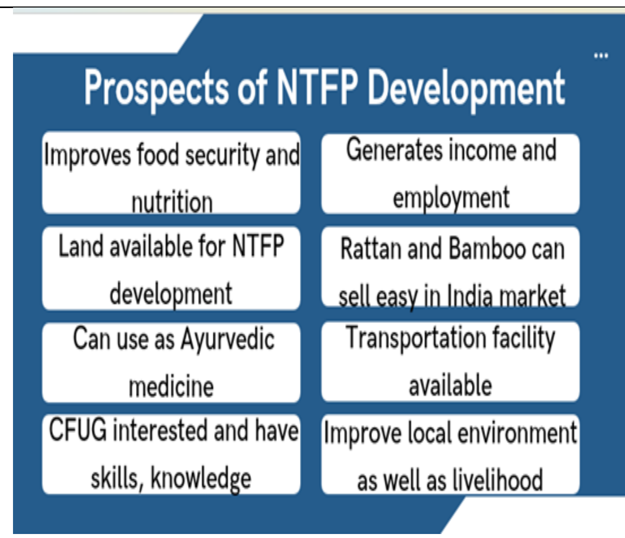
Criteria	Amala	Bamboo	Bel	Bet	Barro	Niguro	Sal	Pipli
Market demand	2	3	3	3	3	2	2	3
Profit	2	3	2	3	2	1	1	2
Availability in time	1	3	3	1	1	3	3	2
Impact of harvesting on survival	2	3	2	2	2	3	1	2
Regeneration potential	1	3	2	1	1	3	2	1
Contribution to income	1	3	2	3	2	1	1	2
Gender impact	3	2	2	2	2	3	2	2
Potential for employment creation	1	3	3	3	2	1	1	2
Uses	3	3	3	2	2	2	2	2
Total Score	16	26	22	20	17	19	15	18
Rank	7th	1st	2nd	3rd	6th	4th	8th	5th



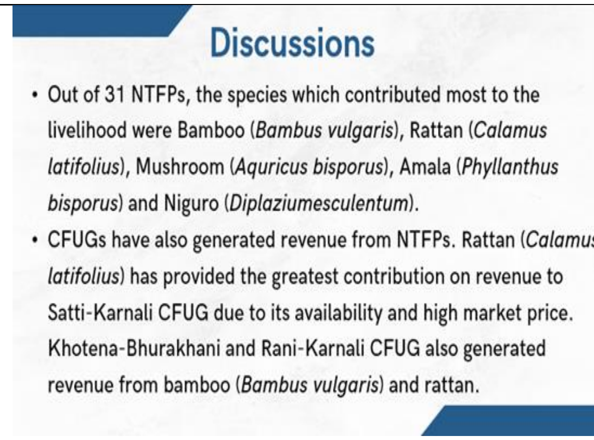


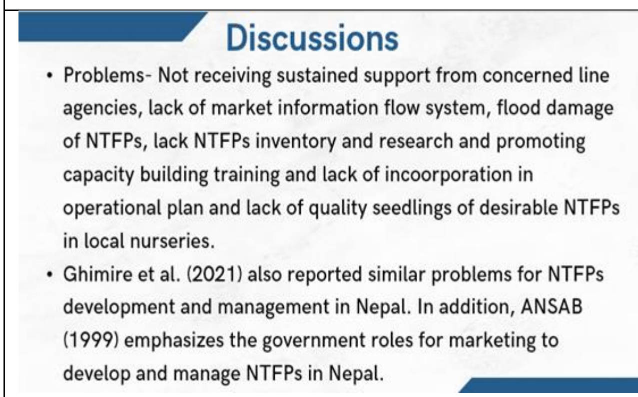


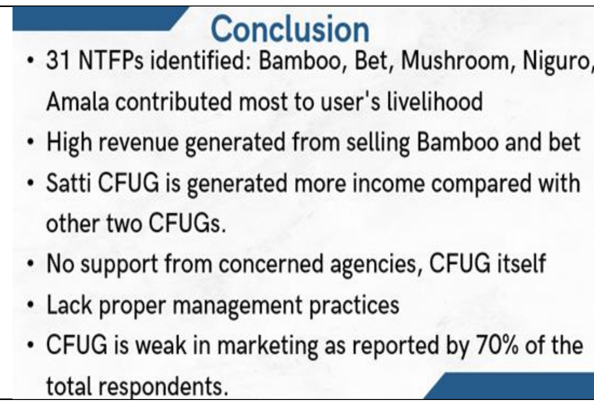





Problems
1 Research and Inventory
2 Lack of NTFP prioritization
3 Reoccuring floods
4 No marketing information
5 No value addition


Discussions
• Out of 31 NTFPs, the species which contributed most to the livelihood were Bamboo (*Bambus vulgaris*), Rattan (*Calamus latifolius*), Mushroom (*Aquricus bisporus*), Amala (*Phyllanthus bisporus*) and Niguro (*Diplaziumesculentum*).
• CFUGs have also generated revenue from NTFPs. Rattan (*Calamus latifolius*) has provided the greatest contribution on revenue to Satti-Karnali CFUG due to its availability and high market price. Khotena-Bhurakhani and Rani-Karnali CFUG also generated revenue from bamboo (*Bambus vulgaris*) and rattan.


Discussions
• Problems- Not receiving sustained support from concerned line agencies, lack of market information flow system, flood damage of NTFPs, lack NTFPs inventory and research and promoting capacity building training and lack of incoorporation in operational plan and lack of quality seedlings of desirable NTFPs in local nurseries.
• Ghimire et al. (2021) also reported similar problems for NTFPs development and management in Nepal. In addition, ANSAB (1999) emphasizes the government roles for marketing to develop and manage NTFPs in Nepal.


Conclusion
• 31 NTFPs identified: Bamboo, Bet, Mushroom, Niguro, Amala contributed most to user's livelihood
• High revenue generated from selling Bamboo and bet
• Satti CFUG is generated more income compared with other two CFUGs.
• No support from concerned agencies, CFUG itself
• Lack proper management practices
• CFUG is weak in marketing as reported by 70% of the total respondents.

Recommendation

- Operational plan of Community forest should emphasize on NTFP too
- Proper inventory and research work should be done on NTFPs in order to assess the availability and potential of NTFPs
- Capacity training should be done on the utilization

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Gallery


A WASH Framework to Assess the Climate Resilience of Water Supplies in Nepal

Moti Poudel[1, 3], Anish Ghimire[1], Subodh Sharma[1,3, *], Anisha Nijhawan[2], Guy Howard,[2] Manish Baidya[3], A.Flint[4]

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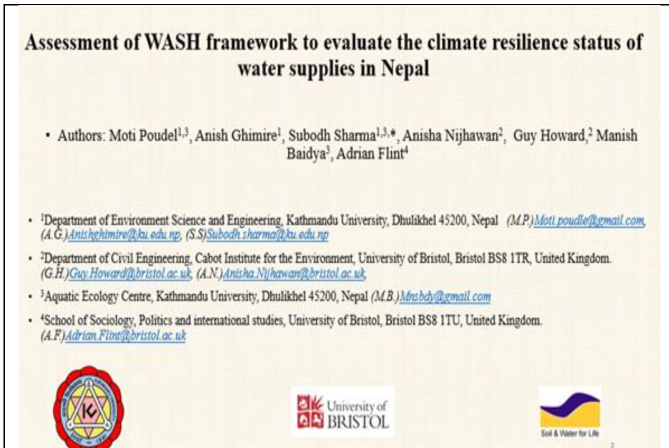
Abstract

Nepal is one of the most affected countries due to the impact of climate change. The impact can be mitigated with climate resilience initiations and practices that can strengthen the ability of vulnerable communities prone to climate change. The availability of water sources in Nepal is widely praised while access to safe and sustainable water supplies is still an issue and needs prioritization. The impact of climate change on water sources has been confirmed but the quantification of the impact was overshadowed. The assessment of the climate resilience status of water supplies has now been possible with the introduction of the How tough is WASH framework. The quantitative metric value to scale the impact of climate change on water supplies with the six major indicators has helped to identify the climate resilience status of water supply schemes. In total, 15 protected water sources from Ghandruk and Chitwan were assessed with this framework. The priority of actions to conserve and make the water supplies sustainable was evaluated on a scale of 1 to 5 for the environment, infrastructure, management, institutional support, community governance, and supply chain. The result shows that the water supplies are low to moderate resilient to climate change. The water schemes need an urgent effort of improvement to make them resilient to the impacts of future climate change through financial and technical support. This framework can be highly acceptable guidelines among the community to make their water sources more resilient by understanding the actions to be implemented.

***Keywords*:** Climate resilience, Water supplies, WASH framework

Moti Poudel



Assessment of WASH framework to evaluate the climate resilience status of water supplies in Nepal
• Authors: Moti Poudel[1,3], Anish Ghimire[1], Subodh Sharma[1,3,*], Anisha Nijhawan[2], Guy Howard,[2] Manish Baidya[3], Adrian Flint[4]
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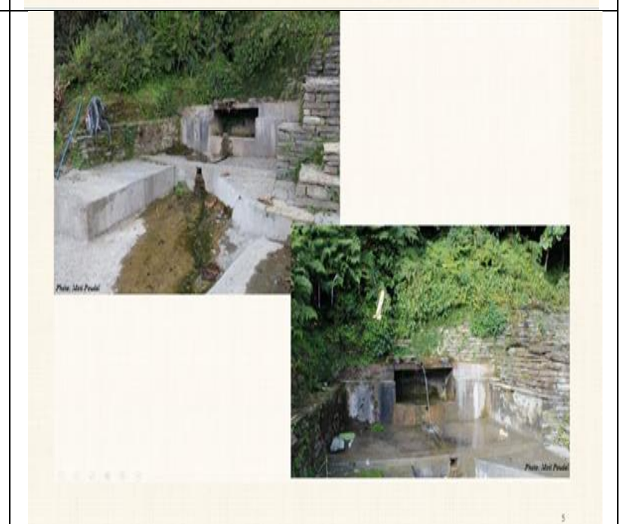
University of BRISTOL
Soil & Water for Life
2

Research Sharing
Nijhawan A, Howard G, Poudel M, Pregnolato M, Eunice Lo YT, Ghimire A, Baidya M, Geremew A, Flint A, Mulugeta Y. Assessing the Climate Resilience of Community-Managed Water Supplies in Ethiopia and Nepal. Water. 2022; 14(8):1293. https://doi.org/10.3390/w14081293
3

NEPAL
COUNTRY CLIMATE AND DEVELOPMENT REPORT
GLOBAL CLIMATE RISK INDEX 2020
USAID
NEPAL
73.2% of spring sources with reduced flow and 12.2 % dried sources over decades in watershed of Thulokhola, (Poudel et al. 2017)
Nepal ranks 126 in climate vulnerability index with vulnerability score of 0.521 and readiness 0.356 (NG-GAIN, 2022)
Nepal ranks 10th position as a most affected country in the world (Eckstein et al., 2021)
Decrease in the yield of the spring source upto 50% at Tanahau in-between 2004 to 2014 (RWSSP-WN 2016)
4



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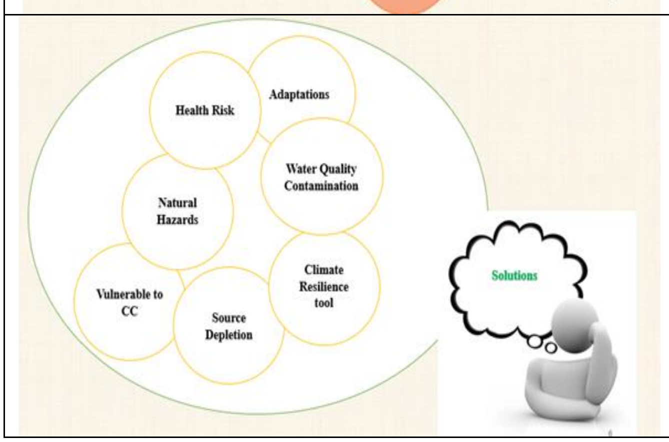
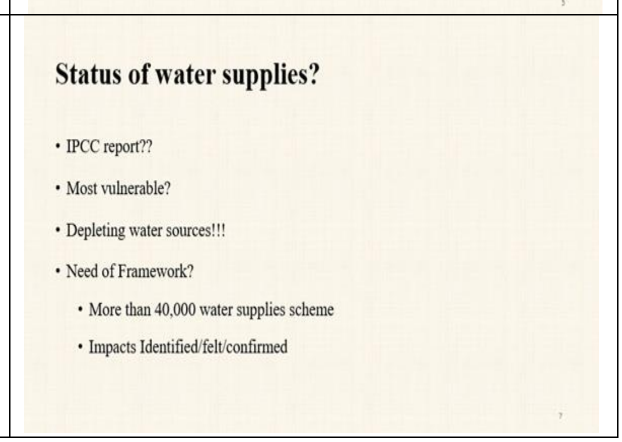


Health Risk
Adaptations
Water Quality Contamination
Natural Hazards
Climate Resilience tool
Vulnerable to CC
Source Depletion
Solutions



Status of water supplies?
• IPCC report??
• Most vulnerable?
• Depleting water sources!!!
• Need of Framework?
• More than 40,000 water supplies scheme
• Impacts Identified/felt/confirmed
7

Efforts

- Water Safety Plan
- Climate Resilient-Water Safety Plan
- Self managed community water supply system
- Support from INGO
- ……………..

WASH-Framework

- Started from: 2019 (October)
- Finalized: 2021 (July)
- Piloted at different schemes
  - Hilly area
  - Terai

Source: Howard et al., 2021

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Methodology

- Stakeholder consultation (National and International workshops)
- Seasonal water quality/ quantity assessment
- Spatial Analysis
- Tested questionnaire for FGD and KII
- FGD/KII with WUSC/community/Government agencies/chiefs…
- Seasonal Sanitary Inspection (WHO_Protocols)
- Field visit and observation

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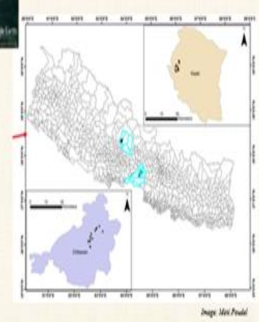
Study Area



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Prioritization of water supplies by resilience score

TOTAL SCORE	RESILIENCE	PRIORITY	QUALIFIER	ACTION
25-30	Very high	Low	If score reduces because of failure on one domain, action required in that domain	Maintain performance
19-24	High	Low	Action focused on specific indicator failures	Limited improvements
13-18	Medium	Medium	Likely to be across multiple indicators	Substantial improvements
7-12	Low	High	Action required across all indicators	Large-scale improvements
6	Very low	Very high	Action required across all indicators	Systemic improvements

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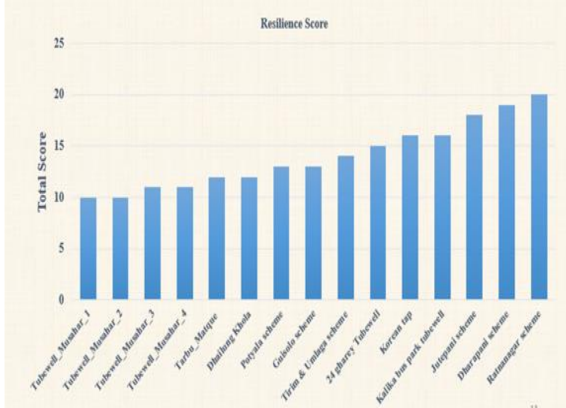

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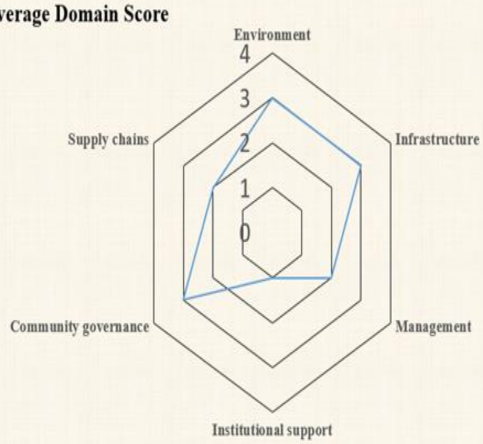
Average Domain Score



Take away message

- Institutional support was found very poor
- Deep boring: higher resilience
- Traditional spring source: More vulnerable to CC
- Functional WUSC with sufficient trainings is must
- Huge investment required

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For More information

Developing HTIW-Framework

Research Paper HTIW-Framework

Howard, G.; Nijhawan, A.; Flint, A.; Baidya, M.; Pregnolato, M.; Ghimire, A.; Poudel, M.; Lo, E.; Sharma, S.; Mengustu, B.; et al. The how tough is WASH framework for assessing the climate resilience of water and sanitation. npj Clean Water 2021, 4, 39.

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Socio-Economic Determinants of Tree Composition and Their Carbon Stock in Smallholder Community Farms (A Case Study from Kuleni, Nawalpur, Nepal)

***Utpal Devkota[1], Dinesh Raj Bhuju[1], Sushil Paudel[1], Niraj Mahat[2], Purna Prasad Dhakal[3]**
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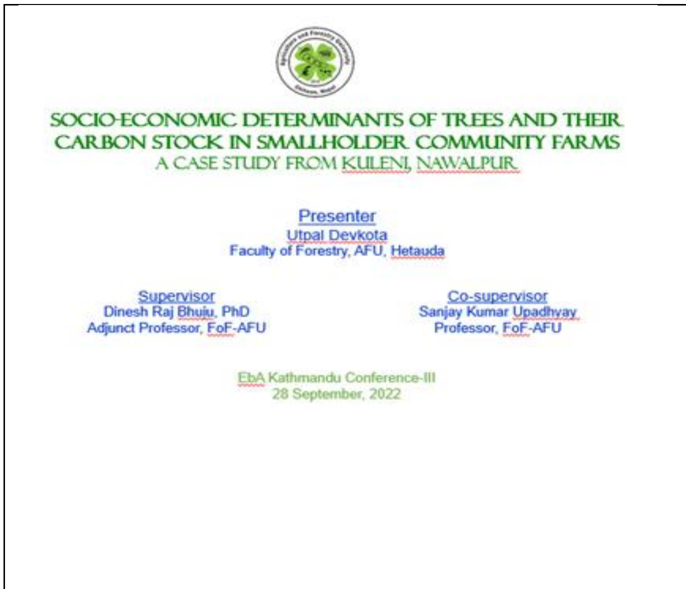
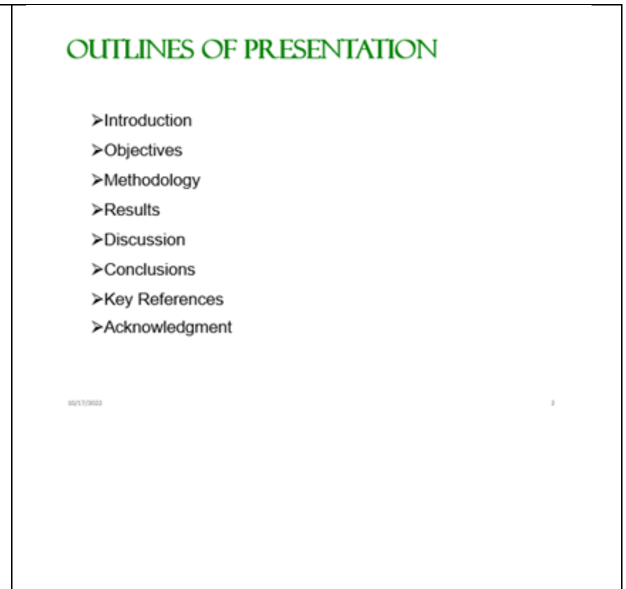
Abstract

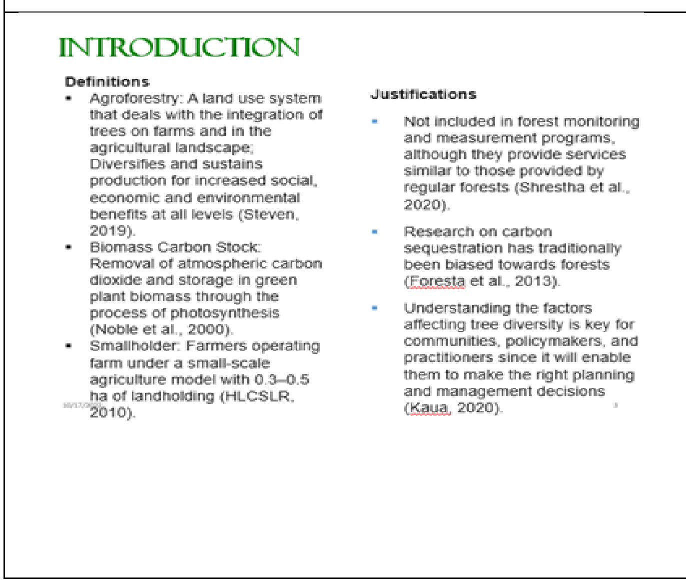
The practice of growing trees on farmland has long been associated with the rural areas of Nepal. Studies related to carbon sequestration have mainly focused in forest carbon and that in trees of farmland has rarely been studied. This work aims to estimate the tree species composition, their diversity, their socio-economic determinants, and carbon stock of tree biomass in smallholder community's farmland. The study was conducted in Kuleni village of Devchuli Municipality in Nawalpur district which is developing as a Climate Smart Village. The present study surveyed a total of 75 Households of the smallholder communities generating data on ethnicity, education, sex of household head, income and consumption of tree products. Based on the inventory of the farms of sampled households, this study assessed the species diversity, richness, and carbon storage in Trees Outside Forest in various socioeconomic strata. Species diversity was highest in the farmland owned by Indigenous according to caste, fodder species according to the uses of trees planted and Melia azaderach according to the species. Apparent determinants of tree species growing by the farmers were identified through regression; including the size of farmland, People having excess to extension services, income and age of the household head. Among all the variables, only the landholding variable was statistically significant. Income and age were negatively correlated to the number of species. Furthermore, the carbon stock per household varied significantly with the amount of land, caste, annual income, and the number of tree species planted. Tree diversity in the agricultural landscape could play positive role in the long-term stability and resilience of both humans and ecology and the total amount of carbon calculated signifies that having trees on farmland could minimize the environmental challenges and reduce the climate stress.

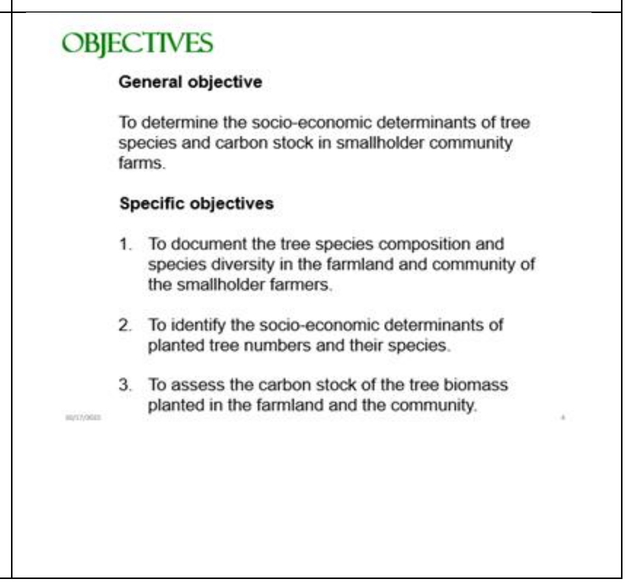
***Keywords*:** Carbon stock, Determinants, Diversity, Farmland, Smallholders, Socio-economic

Utpal Devkota







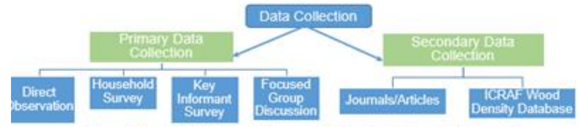


METHODOLOGY

- Kuleni, Devchuli Municipality, Nawalpur District, Gandaki Province
- Total Household: 476
- Border to the Chitwan National Park in the South

Figure 1: Map of the study area

DATA COLLECTION



DATA ANALYSIS

- Trees diversity analyzed using the Simpson's and the Shannon–Wiener Diversity Index.
- OLS regression model used to analyze the socio economic factors responsible for the extent of tree growing on farmland where the number of trees was used as dependent variable and various socio economic variables were used as explanatory variables.
- Allometric equation was used in estimating Above ground tree biomass and then sum of tons of CO_2 equivalent was calculated as per the various variables.
- The data obtained from the Household survey were analyzed and interpreted using MS-Excel and SPSS statistical software.

RESULTS

Table 1: Ethnicity and Landholdings in the study site Kuleni, Nawalpur, Nepal

SN	Ethnicity	Landholdings (ha)						Tree Number
		A	B	C	D	E	F	
1	Bhrahmin/Chettri	119	145	52	-	-	12	328
2	Dalits	20	-	-	-	-	-	20
3	Indigenous	67	58	52	-	-	5	182
4	Tharu	66	25	-	-	-	-	91
	Grand Total	272	228	104	-	-	17	621

A= (0 - 0.1), B = (0.1 - 0.2), C= (0.2 - 0.3), D = (0.3 - 0.4), E= (0.4 - 0.5), F = above 0.5

Table 2: Species diversity according to the uses of trees planted

Uses	No. of trees	pi	ln pi	pi*lnpi
Fodder	439	0.71	-0.35	-0.25
Fruit	132	0.21	-1.54	-0.33
Fuelwood	3	0.00	-5.33	-0.03
Timber	44	0.07	-2.64	-0.19
Other	3	0.00	-5.33	-0.03
Grand Total	621	1.00	0.00	-0.82
Shannon-Weiner Diversity Index				0.82
Effective no of species (ENS)= EXP(H')				2.26

Table 3: Use category of trees planted in Kuleni, Nawalpur, Nepal

SN	Uses	No. of trees	Species Composition %
1	Fodder	439	70.5
2	Fruit	132	21.4
3	Fuelwood	3	0.5
4	Timber	44	7.1
5	Other	3	0.5
	Grand Total	621	100.0

Total number of tree species observed: 42

Table 4: Major tree species planted in Kuleni village, Nawalpur, Nepal

SN	Scientific Name	Common Name	Uses	HH Number	Occurrence %	Trees Number
1	*Melia azederach*	Bakaino	Fodder	57	76.0	260
2	*Mangifera indica*	Mango	Fruit	40	53.3	62
3	*Psidium guajava*	Guava	Fruit	28	37.3	41
4	*Morus alba*	Kimbu	Fodder	22	29.3	33
5	*Tectona grandis*	Teak	Timber	1	1.3	29
6	*Garuga pinnata*	Dabdabe	Fodder	19	25.3	27
7	*Ficus rosenbergii*	Nemaro	Fodder	11	14.7	27

Table 5: Socio-economic determinants by correlation among the variables

Variables	Unstandardized Coefficients B	Std. Error	t	Sig.
Intercept	7.643	7.734	.988	.327
Sex of HH(Male=1)	.868	.647	1.343	.184
Age	-.260	1.218	-.213	.832
Income	-.081	.398	-.205	.839
Education	-.121	.097	-1.251	.216
Land (in ha.)	.983	.402	2.443	.017*
Ethnicity=Indigenous	.331	.697	.475	.636
Ethnicity=Dalits	-1.319	1.155	-1.143	.258
Ethnicity=Tharu	-.718	.976	-.735	.465
Occupation=Service	-.105	2.580	-.041	.968
Occupation=Remittance	-.649	1.599	-.406	.686
Off farm income (Yes=1)	.894	.584	1.531	.131
Extension Services (Yes=1)	.593	.667	.890	.377
F value	1.87, p<0.05			
R squared	0.28			
Adj. R squared	0.13			

Table 6: Carbon stock as per the uses of the species planted in Kuleni, Nawalpur, Nepal

Uses	Sum of AGTB	Sum of Tons of CO_2 equivalent
Fodder	240,634.23	882,325.51
Fruit	50,103.12	183,711.43
Fuel wood	6,496.93	23,822.07
Timber	60,397.51	221,457.53
Other	8,574.64	31,440.34
Grand Total	366,206.42	1,342,756.88

Table 7: Carbon stock as per the landholdings in Kuleni, Nawalpur, Nepal

Landholdings	Sum of AGTB	Sum of Tons of CO_2 equivalent
A	135,560.03	497,053.44
B	136,831.86	501,716.82
C	64,022.53	234,749.28
D	0	0
E	0	0
F	29,792.00	109,237.33
Grand Total	366,206.42	1,342,756.88

A= (0 - 0.1), B = (0.1 - 0.2), C= (0.2 - 0.3), D = (0.3 - 0.4), E= (0.4 - 0.5), F = above 0.5

DISCUSSIONS

- Fodder consumption is the main reason for planting trees on farm land which contradicts the result of the study carried out by Ndayambaje et al., (2013) that showed fuel wood consumption as the main reason for planting.
- Undersupply of alternative energy increase the use of firewood for domestic purposes.
- Household with larger landholding was likely to maintain a greater number of species in their farmland. This study supports the results of the study carried out by Oli et al., (2015) that farmers who grow trees have larger average landholdings compared with farmers who do not grow trees.
- HHs with a small amount of land always prioritize agricultural production rather than planting and conserving trees.

- The income has no significant relation with the number of species planted in the farmland of the surveyed households. This result is supported by the findings of the study carried out by Oli et al., (2015).
- It reflects the general importance of trees for rural livelihoods, arguing that rural characteristics may be more marked in terms of physical assets.
- Among the different species recorded in the sampled household of the study area, Fodder and Fuelwood species was recorded to have the highest and lowest carbon stock respectively.
- This result corresponds to the study carried out by Mbow *et al.*, (2014b) which states that the total carbon stock depends on species composition and tree species selection.
- The Carbon stock were the highest in the farmlands of Brahmin/ Chettri people according to caste that is in accordance with the study carried out by Bhandari et al., (2021). The higher number of trees per HH could have contributed to the higher amount of carbon stock of their farms.

CONCLUSIONS

- Total 621 number of trees of 42 species was observed
- Various tree species incorporated in the farmland; giving emphasis mostly to the fodder species
- Having sufficient landholdings would be an incredible opportunity to maintain a greater number of tree species in their farmland.
- The carbon stock per HH varied significantly with the amount of land, ethnicity, species, and uses.
- The total tons of CO_2 calculated in the farmland of the sampled household suggest that the area could have a potential for minimizing the climate stress faced by the farmers in that study area.

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Components of Soil Respiration and its response to Soil Temperature and Moisture in Subtropical Broadleaved Forest of Godawari, Central Nepal

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Abstract

Soil respiration represents one of the major mechanisms of carbon loss from forest ecosystems. Analyzing autotrophic respiration (R_A) and heterotrophic respiration (R_H) helps to understand carbon balance in forest ecosystems in changing global climate. The study was carried out in subtropical broadleaved forest dominated by *Schima wallichii* and *Castanopsis indica* to investigate soil respiration rate and its components autotrophic respiration (R_A) and heterotrophic respiration (R_H). Trenching method was conducted to partition respiration by roots (R_A) and by microorganisms (R_H). Closed chamber method was adopted. Portable Infra-Red Gas Analyzer (IRGA) was used to measure CO_2 concentration in control and trenched chambers every month for one year period. Temperature and soil water content were measured to analyze the effect of these environmental variables on soil respiration rate. The results revealed that CO_2 emission rate of the studied forest soil (R_S) was 248.2±16.6 mg $CO_2m^{-2}h^{-1}$.There was nearly equal contribution of components of soil respiration Ra and R_H with values 123.2±7.41 and 125.9±7.42 mg $CO_2m^{-2}h^{-1}$ respectively. Autotrophic (R_A) and heterotrophic respiration (R_H) showed significant relationship ($p<0.05$) with both soil temperature and soil water content. Soil temperature explained 41.6 % and 56% variability to autotrophic and heterotrophic respiration respectively. The soil respiration and its components showed seasonal variation and responded differently to temperature and moisture.

Keywords: Soil CO_2 efflux, Autotrophic respiration, Heterotrophic respiration, Soil temperature

Sanu Raja Maharjan

Components of soil respiration and its response to soil temperature and moisture in subtropical broadleaved forest of Godawari, Central Nepal

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INTRODUCTION

Background of the Study

- Forest soils are important globally as large amount of carbon is stored as soil organic matter.
- Soil respiration represents one of the major mechanisms of carbon loss from forest ecosystems. (Raich and Potter 1995).
- Soil respiration emits about 10 times more CO_2 to the atmosphere annually than fossil fuel combustion (Bond-Lamberty & Thomson, 2010).
- A change in soil respiration could lead to a huge variation of CO_2 concentration in the atmosphere.

Background Contd..

- Soil respiration is derived from –
  - metabolic activity by root (autotrophic respiration)
  - Microbial communities (Heterotrophic respiration (Hogberg et al. 2001.).
- Study of soil respiration helps to understand carbon balance in forest ecosystems.
- It is necessary to understand how forest soils could be affected by change in environmental factors.

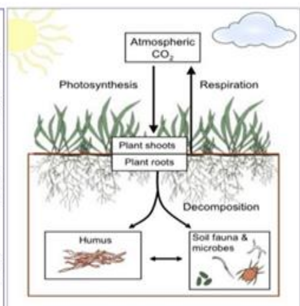


Fig 1. Soil Carbon storage and emission

Objectives

General objective-

- To analyze carbon dioxide emission rate from forest soil and from the autotrophic and heterotrophic components

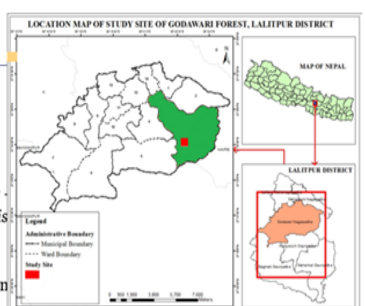
The specific objectives include-

- (b) To assess CO_2 eflux by soil and its autotrophic and heterotrophic components,
- To analyze seasonal variation of soil respiration and its components
- (c) To examine the responses of soil respiration to soil temperature and moisture.

MATERIALS AND METHODS

Study Area

- ➢Forest of Godawari
- ➢ Managed by Naudhara CFUG, at foothill of Phulchoki
- ➢Forest type- Subtropical broadleaved forest dominated by *Schima wallichii* and *Castanopsis* spp..
- ➢Altitudinal range of 1400-1800m



Map showing study area

Methods of Data Collection

Establishment of PVC collars/chambers

- Area of 1 hectare(100m x 100m) selected within the forest
- 5 Trenches of 50cmx50 cm size and 40 cm depth were established randomly within the experimental sites as used by Lee et al (2003).
- 10 Circular PVC collar/chambers (18 cm in diameter and 16 cm in height)were installed in trench and outside the trench..

Trenched plot

PVC chamber in control plot

Methods of Data Collection

Measurement of Soil respiration rate

- CO_2 effluxes were periodically measured every month for a year
- closed chamber method (IRGA technique) (Bekku et al., 1995).
- Infrared Gas Analyzer (IRGA) was fitted in the chambers to measure CO_2 Concentration and gas temperature.
  The soil carbon emission rate was calculated from the following equation (Bekku et al, 1995)

  F= (V/A) (Δc/Δt)
- Where,
  - F= Soil respiration (mg $CO_2 m^{-2} h^{-1}$);
  - V= Volume of air within the chamber (m^3);
  - A= Area of the soil surface within the chamber (m^2);
  - Δc/Δt is the time rate of change of the CO_2 concentration in the air within the chamber (mg CO_2 m^{-2} h^{-1}).


Vaishala Carbocap CO2 sensor

Estimation of temperature sensitivity(Q10 value)

- an equation of exponential regression- $SR_T = a \times \exp^{b \times T}$ was used for calculation of Q 10 value.
- The Q10 value was calculated by inserting the parameter b into the equation-
- $Q10=\exp^{10 \times b}$
- Q_{10} (value), describes the changes in soil respiration over a 10°C increase in soil temperature.

Methods of Data Collection

Soil temperature and soil water content (SWC)

measurement of soil temperature using the digital lab stem thermometer(AD-5622, Japan).

measurement of soil water content (SWC) by using soil moisture sensor TRIME-FM (Imko, Germany).

Continuous measurement of soil temperature by Stowaway Tidbit Temperature Data Logger.


Lab stem thermometer


Moisture Sensor


Temperature Data Logger

Results

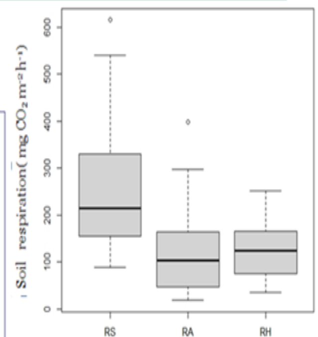
Total soil Respiration and its components

Soil Respiration Rate(mg $CO_2 m^{-2} h^{-1}$)

Average soil Respiration(Rs)= 248.2±16.6

heterotrophic respiration (R_H)= 125.9±7.42

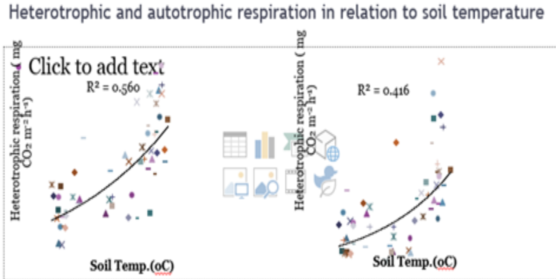
Autotrophic respiration (R_A)= 123.2±7.41



Box plot showing soil respiration in different components

Results

Heterotrophic and autotrophic respiration in relation to soil temperature



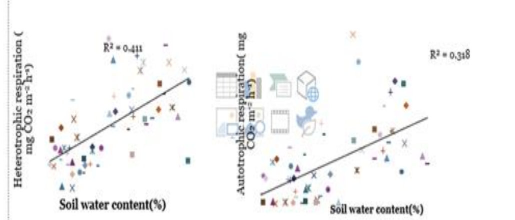
Significant relationship ($p<0.05$) between soil respiration and soil temperature

Q10 value of Heterotrophic(R_H) = 2.8 and for Autotrophic(R_A)= 2.0.

Results

Heterotrophic and autotrophic respiration in relation to soil water content(%)

- Click to add text



Results

Seasonal variation of Heterotrophic and autotrophic Respiration

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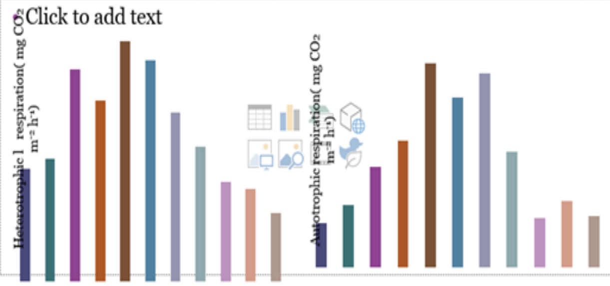
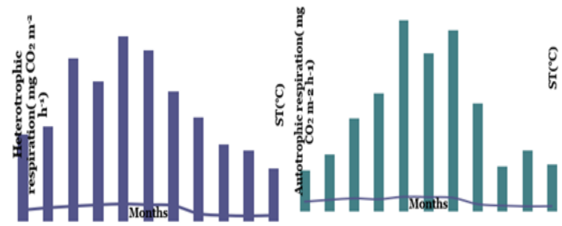


Results

Seasonal variation of R_A and R_H with soil temperature



Results

Seasonal variation of Ra, Rh and soil water content

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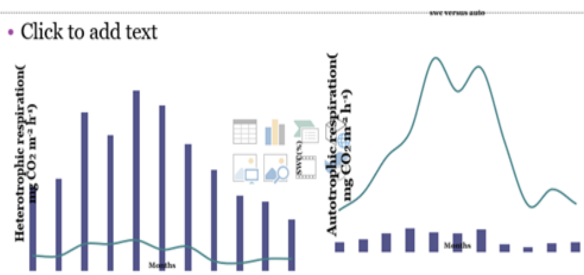

Discussion

Click to add title

- Average soil respiration rate- 248.2±16.6 mg $CO_2 m^{-2} h^{-1}$
- Soil respiration rate depends on vegetation type and environmental conditions (Raich, 2000)
- Autotrophic respiration-
  - 38 % to 45% in forests of Hainan, China (Jiang et al, 2017),
  - 27 to 71% in deciduous forest of Japan((Lee et al. 2003).
  - between 50% and 60% in temperate deciduous forest of North America(Hanson et al., 2003)

Click to add title

- The components of soil respiration respond differently to temperature and moisture.
- The temp. sensitivity value of global forest soil respiration was in average 2.4(Raich, 1992).
- Sensitivity is affected by vegetation type(Yu et al, 2017) ; decrease from poles to equator (Bekku et al., 2004) etc.
- Higher temperature due to climate warming will result into increase of both R_H and R_A.

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Click to add title

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Living in Koshi Floodplain: Mobile Human Settlement and Reliance on Local Resources are Adaptation Strategies to Disaster Risk Reduction

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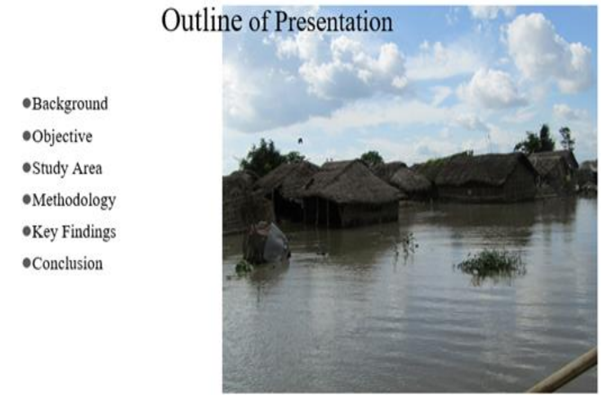
Abstract

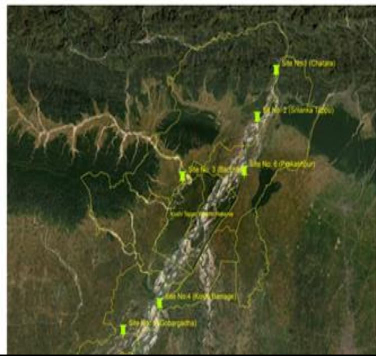
Local communities living in disaster-prone areas have long been using unique adaptation strategies based on socio-cultural systems, local context, and environmental resources at their disposal. Such an ecosystem-based approach (EbA) integrates the use of biodiversity and ecosystem services to adapt to various types of disasters. Here, we examined how local communities in Sri Lanka Tappu (Gariya Tappu) and Gobargada of Koshi floodplains have been using environmental resources to cope with recurrent floods and river channel shifting. We found that abundant and productive lands, suitable for animal husbandry and agriculture production, provided critical livelihood support, where a swift shift of human settlement in response to the change in the river channel, was an effective coping strategy. Almost all the construction materials of house and buffalo shed (98%), including mats and baskets are made of three plant species, which are abundant in the surrounding. Houses are made in such a way that they can be disassembled into several pieces, making them easier to transport and assemble in case of need. The shift of houses in the last 50 years ranged from one to 10 (average 2 in Gobargada and 2.2 in Sri Lanka Tappu). We suggest that these strategies are critical for local adaptation to disaster and should be given full consideration in future disaster risk reduction strategies in such areas.

Keywords: Koshi floods, EbA to DRR, Traditional and Local Knowledge, Nepal

Raja Ram Chandra Timilsina



Study Area



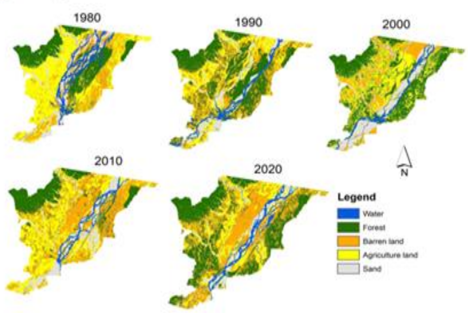
- Koshi -one of the largest rivers in South Asia
- Srilanka Tappu villages is situated on Sunsari district.
- It is sprawl on western side of the Koshi River
- Gobargadha/Chhatauni village is located in the southern part of the Saptari district
- 12 km away from the Koshi Barrage

Methodology

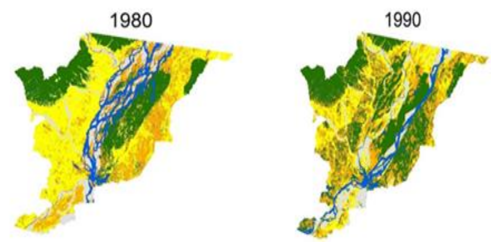
- Ethnography with hybrid approach of data collection

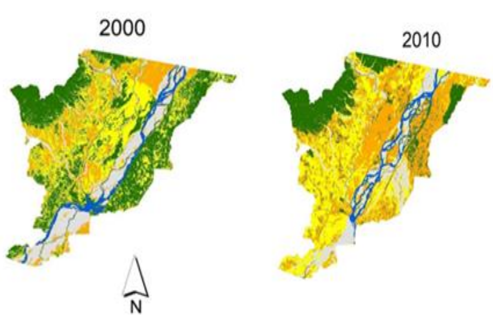
Key Findings

1) Koshi River Dynamics



Compare

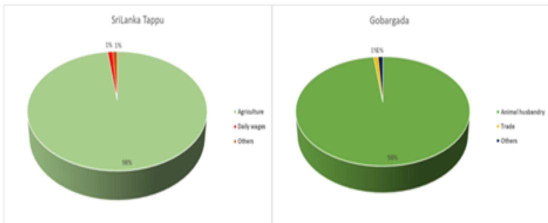




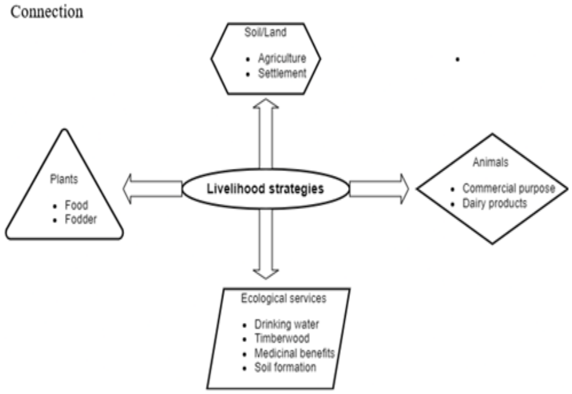
3)Enabling Factors

a) Livelihood factors

- Agriculture and Animal Husbandry are the source of livelihood



Connection



b) Local Resources

- Inclusive use of local resources

Cattail	Kans	Jhauwa	Narkat
Typha elephantine	Saccharum spontaneum	Tamarix dioica	Phragmites karka
· Making mats · Chair seats. · Fenching	· Ropes · Baskets · Huts (roof) · Broom	· Firewood · Broom · Fencing · Trade	· Fencing · Sheds

Use of resources

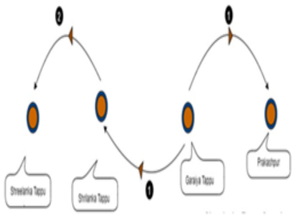
c) Construction Pattern

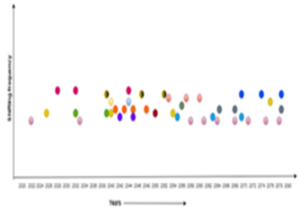
- Almost all of the construction materials of house and buffalo sheds i.e. 98% uses of local resources.
- Houses are made in such a way that they can be disassembled into several pieces, potable easier to transport and assemble in case of need.

Shifting Pattern

Sri Lanka Tappu

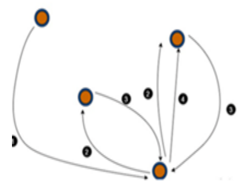
5 shifts in the last fifty years.
Average shifting range (1 to 5 shifts)
Average number shift of each house 2 ± 0.3

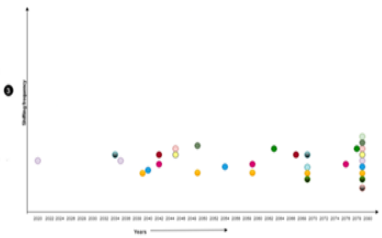




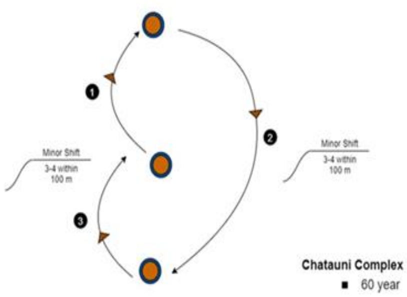
Gobargada village

10 shifts in the last fifty years.
Shift within a shorter distance (1 to 10 shifts)
Average number shift of each house 2.2 ± 0.46





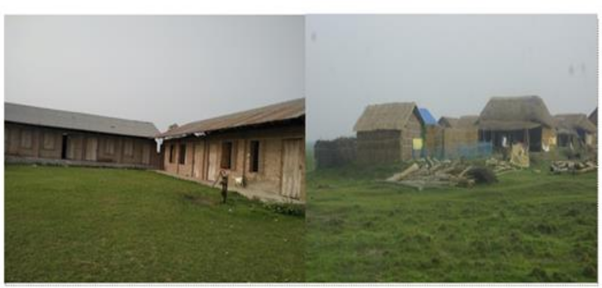
Chautani Village



Recommendations

- Livelihood strategy are based on the uses of local resources.
- The construction pattern of houses are found temporal with full uses of local recourses (98%)
- But the investment of government financial plan found speculative
- It is suggested to the local and central government to make a proper planning while allocating the budget on those area.
- Keeping more important on an ecosystem-based approach (EbA) integrates the use of biodiversity and ecosystem services to adapt such disasters.

Tragedy of commons



PRESENTATIONS

Session II: EbA Research Sharing

Scaling up Mountain Ecosystem based Adaptation in Nepal

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Abstract

Nepal is a mountainous country with rich social, cultural, and natural resources and is one of the most vulnerable countries to climate risks due to its complex topography, variability in climate and micro-climatic conditions, and nature-based livelihoods. Nepalese ecosystem and its services are not left behind from these risks, leading to long- term effects on food security as well as in people's livelihoods. Therefore, in order to enhance resilience of mountain ecosystem and its services, IUCN has been directly involved in Ecosystem Management activities since the year 2011. Initially, IUCN piloted and demonstrated the role of Ecosystem based Adaptation (EbA) and Ecosystem based Disaster Risk Reduction (Eco-DRR) measures in enhancing resilience of ecosystem and communities in Panchase Protected Forest area of western Nepal. The common natural phenomena of Panchase area are landslides and flash floods and major ecosystems are forests (49%) Agriculture (47.61%) and water bodies (0.29%). After successful piloting of EbA and Eco-DRR, IUCN did documentation and generation of evidence for EbA effectiveness and is currently promoting EbA and Eco-DRR approaches through upscaling and replicating best practices and lessons from previous projects and activities. All the activities were implemented in the same geographic region by adopting integrated and participatory approaches to address climate risks. EbA and Eco-DRR is a comprehensive adaptation and disaster risk reduction approach for managing ecosystems to increase resilience and maintain essential ecosystem services reducing vulnerability of people to climate and other socioeconomic changes. Form a decade long experience it is found that Nature based Solutions (NbS) principles also complement or similar to EbA and Eco-DRR principles so it can be considered as NbS for addressing CC impacts and enhance ecosystem resilience in Nepal.

Keywords: Mountain Ecosystem, complex Topography, Resilience

Anu Adhikari

IUCN Nepal and EbA

- **Piloting/Learning and Implementation** : EbA, Eco-DRR (implementation (2011-2016): Panchase)
- **Evidence/Assessing Effectiveness:** EbA effectiveness study (Research study (2012-2017) on Eco-DRR and (2015-2019) on Adaptation)
- **Upscaling/Promoting** : Upscaling EbA: Panchase (Flagship) and Chilime (Replicating) (Expanding (2017-2020), GCF Gandaki River Basin (2020-2027)

IUCN Programme Framework

IUCN's Programme Framework 2017-2020

IUCN's Nature 2030 Programme Framework

Approaches of Climate Change Adaptation

Community Based Adaptation

Use of nature or others

Use of Nature and Ecosystem Services

Ecosystem Based Adaptation

IUCN Nepal and EbA

- **Piloting/Learning and Implementation** : EbA, Eco-DRR (implementation (2011-2016): Panchase)
- **Evidence/Assessing Effectiveness:** EbA effectiveness study (Research study (2012-2017) on Eco-DRR and (2015-2019) on Adaptation)
- **Upscaling/Promoting** : Upscaling EbA: Panchase (Flagship) and Chilime (Replicating) (Expanding (2017-2020), GCF Gandaki River Basin (2020-2027)

Piloting/Learning and Implementation : Mt. EbA

- EbA options priority on land rehabilitation, ecotourism, NTFPs and water source conservation

Rati/Jare Sub-watershed

Harpan Sub-watershed

- EbA options priority on land rehabilitation, ecosystem restoration, ecotourism and conservation farming

Andhi Sub-watershed

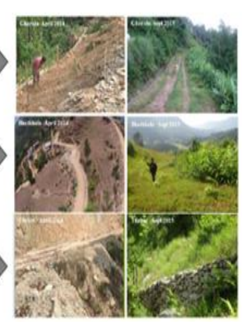
- EbA Options priority on water conservation, agro-ecology, land rehabilitation and livelihood diversification

Piloting/Learning and Implementation : Eco-DRR

Gharelu, Kaski

Bhatkhola, Syangja

Tilahar, Parbat



- Establishment of Bio engineering **demonstration site**
- Research on different **bioengineering species**
- **Capacity building** and
- **Policy influence**

Evidence/Assessing Effectiveness: EbA Effectiveness Study

Research framework on EbA effectiveness

Criteria for Assessing EbA Effectiveness

Adaptive capacity and vulnerability : Does an EbA initiative allow communities to maintain or improve their adaptive capacity or resilience? Does it reduce their vulnerability to CC, while enhancing co-benefits that promote wellbeing?

Ecosystem resilience and services: Does an EbA initiative restore, maintain or enhance the capacity of ecosystems to continue to produce services for local communities? Does it allow ecosystems to withstand CC impacts and other stressors?

Economic viability: Is an EbA initiative financially and economically sustainable

Upscaling/Promoting: Scaling Up Mt. EbA

Goal: To scale up EbA as a means to build climate-change resilience and promote adaptation in mountains

- Emphasis on *mainstreaming* in policy and *expanding* in practice

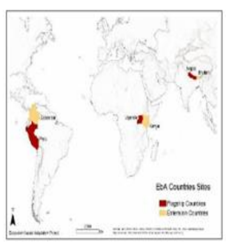
Flagship countries: Nepal, Peru, Uganda

Expansion countries: Bhutan, Colombia, Kenya

Timeframe: July 2017– June 2020 (December 2019) – January 2022 – November 2022

Partners: TMI + country partners

Support: International Climate Initiative by the German Ministry



Mountain EbA objectives, then and now

Mountain EbA Flagship Programme (2012-2016)

- Development of methodologies and tools for EbA decision-making in mountain ecosystems.
- Application of methodologies and tools at ecosystem level.
- Implementation of EbA pilots at ecosystem level.
- Development of business case for EbA at the national level.
- Development of a learning and knowledge management framework.

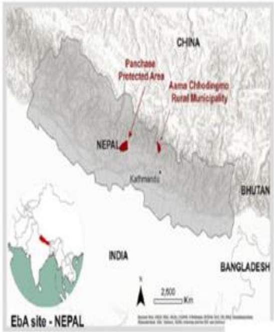
→ Learning and implementation

Promoting Mountain EbA Program (2017-2020)

- Ensure that Flagship and new projects will yield long-term evidence and lessons;
- Extract that knowledge and evidence;
- Build local capacity to replicate successful approaches;
- Inform local, national, and international adaptation plans and policies.

→ Promoting and expanding

IUCN



- Panchase : Continuation of the work in the flagship site : IUCN Nepal
- Out of 13 sub watershed selected one sub watershed i.e. Harpan Khola sub watershed
- Local Partner Organisation: Machhapuchhre Development Organisation (MDO) Nepal
- Chilime: Scale up best learning's of the first phase of Mountain EbA project : TMI Nepal
- Aama Chhodingmo rural municipality of chilime watershed
- Local Partner Organization: Manekor Society Nepal

IUCN

Continuation site : Panchase

- Harpan khola sub watershed : Based on site selection criteria (8)
- Update of Baseline
- Development of M&E tool
- EbA effectiveness and sustainability assessment (Selected EbA measures)
- EbA learning and research sharing (12 result sharing workshop, 3 Workshop in MOFE EbA II working district in collaboration with MoFE
- Awareness raising and capacity building
- Revision of CFUGs operational plan
- Economic analysis of EbA measures
- Exchange learning, training and best practices documentation

IUCN

EbA Effectiveness and Sustainability

- Identified the criteria for sustainability and effectiveness and its indicators
- Criteria for Sustainability – 5 (29)
  - Social – 9
  - Economic – 7
  - Institutional -6
  - Environmental – 6
  - Technical -1
- Criteria for Effectiveness – 4 (19)
  - Human Society – 7
  - Ecosystem – 6
  - Financial – 4
  - Policy and Institutional Issues -2
- Each EbA options has effectiveness and sustainability scoring criteria

IUCN

Replication site Chilime

- Pre-consensus approval meeting with government
- Expert Group Meeting in Kathmandu

- Detail Site Assessment

- Participatory Vulnerability Assessment
- Watershed level Sharing and Prioritization Workshop
- Baseline study
- Identification and implementation of EbA measures (Conservation and promotion of *Paris polyphylla (Satuwa)* cultivation, a high value medicinal plant, Pastureland Improvement in highlands, Bee farming, organic farming, water source protection, plantation

- Awareness raising and capacity building (EbA training manual, EbA training)
- Pastureland management plan

IUCN

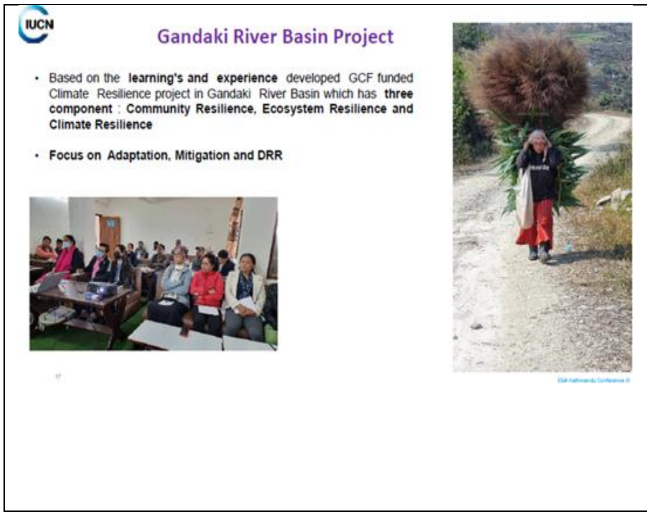
Upscaling EbA

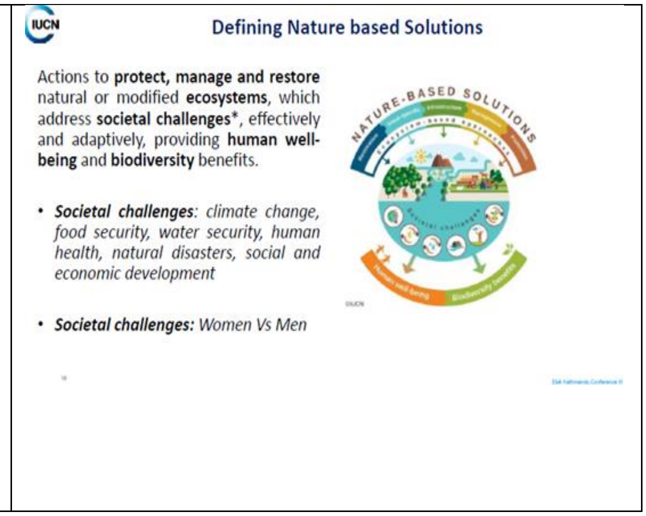
- Local Partner NGOs (MDO, ASK) : Win Adaptation scale prize (project related to EbA)
- Siltation Dam – Pokhara Metropolitan city
- EbA champion elected in local election as a ward chair and members
- Ward supporting pond, organic farming, water source protection , broom grass and other plantation
- Province level ministries annual plan
- Five homestay – Sidhane, Damdame, Boudha tamu- Bange, chitre gramin paryatan - chitre and Panchakoshi – Arther receive money from Province forest ministry USD 10000 for homestay promotions and Agriculture ministry for integrated organic farming and livestock management - USD 5000
- Amriso plantation in cultivated land by communities

IUCN

Upscaling: Strengthening Capacity of Indigenous Women and Youths

- Training on NbS/EbA/Eco-DRR
- Formation of sub-groups for NbS champions (9 members)
- Organize knowledge sharing exposure visits and interactions in sites demonstrating NbS, EbA and Eco- DRR practices


IUCN
Gandaki River Basin Project
• Based on the learning's and experience developed GCF funded Climate Resilience project in Gandaki River Basin which has three component : Community Resilience, Ecosystem Resilience and Climate Resilience
• Focus on Adaptation, Mitigation and DRR


IUCN
Defining Nature based Solutions
Actions to protect, manage and restore natural or modified ecosystems, which address societal challenges*, effectively and adaptively, providing human well-being and biodiversity benefits.
• Societal challenges: climate change, food security, water security, human health, natural disasters, social and economic development
• Societal challenges: Women Vs Men
NATURE-BASED SOLUTIONS


IUCN
Nature-based Solutions Global Standard
Nature based Solutions (NbS) criteria/standard launch on July 2020
Criteria overview: 8 Criteria and 28 Indicators
1. Societal challenges
2. Design at scale
3. Biodiversity net-gain
4. Economic viability
5. Inclusive governance
6. Balance trade-offs
7. Adaptive management
8. Sustainability


IUCN
Few Glimpses
Before
After


IUCN


IUCN
EbA champions


Now we are!!!!
सिन्धुलीमाढीमा जुनारको प्रतिमा बन्नुअघि र पछिको दृश्य
Is these EbA ?????

Unfolding the Nexus between Consumption and Urban Ecosystem Services: A Case of Bheemdatt Municipality, Far-Western Nepal

Samjhana Bista
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Abstract

There is no turning back from urban to rural settings, and the pace of urbanization is rapid. While very few studies have been conducted related to the major issues of unplanned urban areas in terms of green growth, consumption and degradation of urban ecosystems, this paper is presented mainly by reviewing the peer-reviewed journal articles conducted on urban dynamics as well as consumption patterns from developed and developing countries. This study shows that the lifestyle of the citizens plays a significant role in climate change adaptation practices, and mainly greener practices. The common areas of consumption identified by this study include food consumption, choice of transportation and urban recreational services, which have a connection with ecosystem-based adaptation. The agenda of sustainable consumption is still new and challenging in developing countries compared to develop ones, as the former is still dealing with basic needs for survival. The issue is further challenging in developing cities and towns, where the desire for structural changes from an agrarian society to healthy urbanism. Despite this, the “push” towards sustainable consumption is still relevant in urban areas such as Bheemdatt Municipality in Western Nepal, where the importance of urban ecosystem services is multi-fold and promoting ecosystem-based adaptation is hugely potential.

***Keywords*:** Consumption, Urban, Ecosystem services, Ecosystem-based adaptation

Samjhana Bista

Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022

Unfolding the Nexus between Consumption and Urban Ecosystem Services:
A Case of Bheemdatt Municipality, Nepal

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Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022

Presentation Outline

- Background: Consumption and urban ecosystem services
- Why this study?
- Methodology
- Construction of the theoretical framework
- Key findings of reviews
- Case study site

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Background

- Consumers use the resources based on their economic status and standard of living (Huang and Rust, 2011).
- With increasing population growth, the consumption of resources have grown up in many ways.
- Consumption pattern leads to pressure on resources and environmental degradation (Mont and Power, 2010).
- Consumption in urban and Increasing number and size of cities impacts urban ecosystems (Seto et al., 2011) (Sharma et al., 2018) as well as rural ecosystems.
- It ultimately disturbs urban ecosystem services and functions such (Haase et al., 2014).
- Excessive consumption of resources also accelerates the climate change impacts (Howard, 2022).

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Why this study

- Ecosystem services from agricultural fields, old trees, water systems, greenery trees/bushes, wetlands, parks, playgrounds, rain gardens, urban forests and biodiversity and green paths are part of urban ecosystem (Sang, 2021).
- Urban ecosystems provide cultural and protective services (UNEP 2014) but very limited research (eg., Groulx et al., 2017; Caeiro, 2012) has been conducted on how they are utilised.
- Ecosystem-based Adaptation has been officially introduced by the Government of Nepal as a measure to conserve biodiversity and support people's livelihood. However, the nexus between consumption and urban ecosystem services-related research have not been conducted in Nepal.

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Methodology

- This study is the part of the PhD study titled **"Sustainable Consumption for Effective Ecosystem-based Adaptation in Urban and Peri-Urban Settlements in the Lowlands of Nepal".**
- Explore the nexus between consumption and urban ecosystem services
- Search engine: google scholar, reviewed 209 peer-reviewed articles globally published between 1990 to 2022, of which 42 were focused on consumption and urban ecosystem services and urban EbA.
- In addition, various policies, frameworks, and guidelines focused on consumption and EbA in Nepal were reviewed; and reviewed book chapters, research reports, project reports and progress reports produced by the Government of Nepal, Non-Government Organisations and International Organisations.

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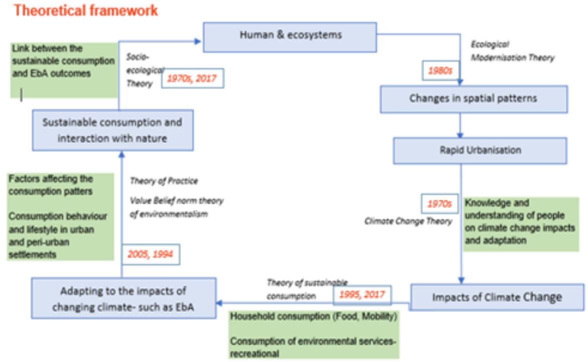
Theoretical framework



Source: Bronfenbrenner, 1989; Glynn, Cadman and Maraseni 2017; Warde 2005; Stern, 1994; Jeroen and Ferrer-I, 1995; Lim (2017).

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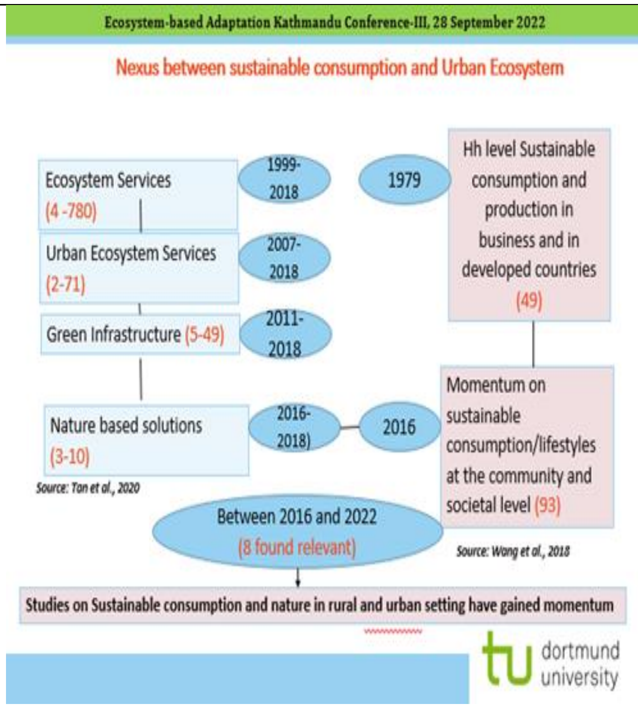
Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022
Nexus between sustainable consumption and Urban Ecosystem
Ecosystem Services (4 -780)
1999-2018
1979
Hh level Sustainable consumption and production in business and in developed countries (49)
Urban Ecosystem Services (2-71)
2007-2018
Green Infrastructure (5-49)
2011-2018
Nature based solutions (3-10)
2016-2018)
2016
Momentum on sustainable consumption/lifestyles at the community and societal level (93)
Source: Tan et al., 2020
Between 2016 and 2022 (8 found relevant)
Source: Wang et al., 2018
Studies on Sustainable consumption and nature in rural and urban setting have gained momentum
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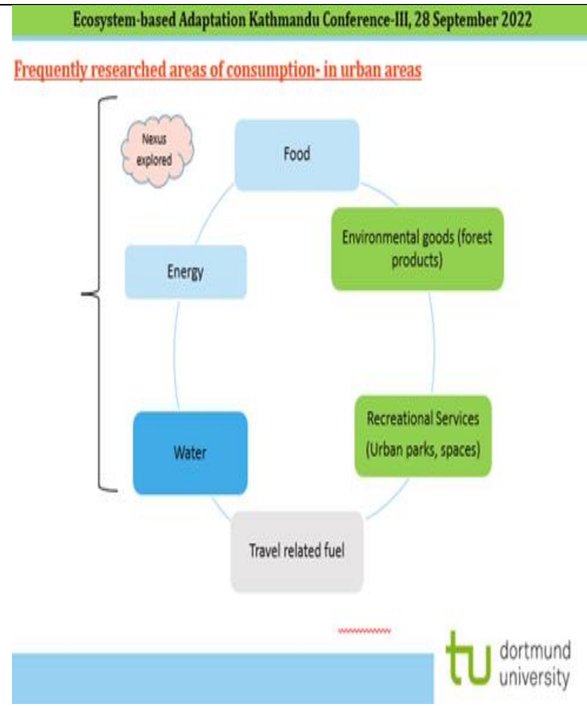
Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022
Frequently researched areas of consumption- in urban areas
Nexus explored
Food
Environmental goods (forest products)
Energy
Water
Recreational Services (Urban parks, spaces)
Travel related fuel
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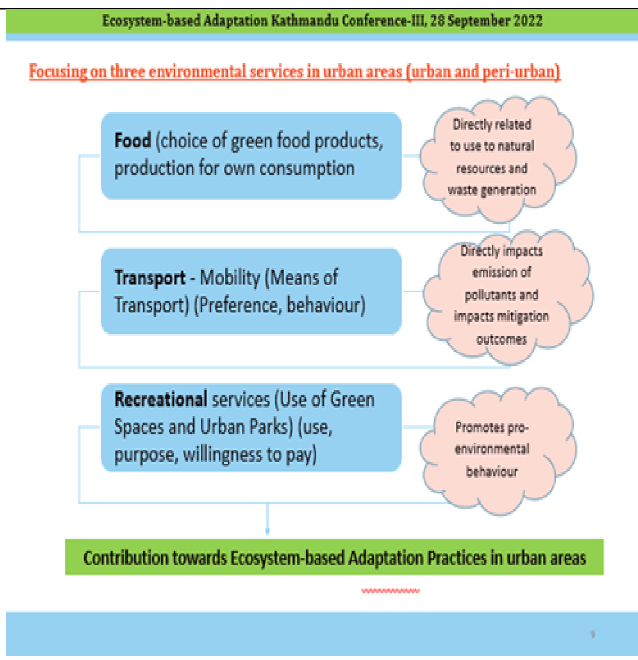
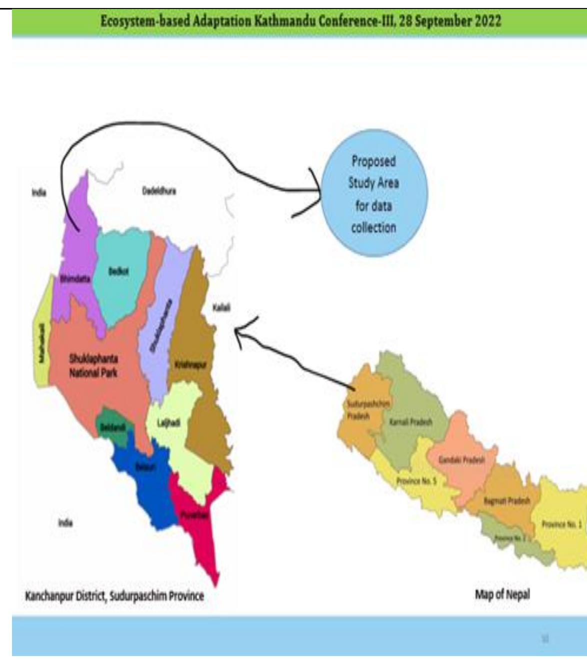

Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022
Focusing on three environmental services in urban areas (urban and peri-urban)
Food (choice of green food products, production for own consumption
Directly related to use to natural resources and waste generation
Transport - Mobility (Means of Transport) (Preference, behaviour)
Directly impacts emission of pollutants and impacts mitigation outcomes
Recreational services (Use of Green Spaces and Urban Parks) (use, purpose, willingness to pay)
Promotes pro-environmental behaviour
Contribution towards Ecosystem-based Adaptation Practices in urban areas


Ecosystem-based Adaptation Kathmandu Conference-III, 28 September 2022
Proposed Study Area for data collection
India
Dadeldhura
Kailali
Shuklaphanta National Park
India
Kanchanpur District, Sudurpaschim Province
Map of Nepal

Indigenous and local knowledge of climate change and their uses in Ecosystem Based Adaptation along the elevational gradients in Gandaki River Basin of Nepal.

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[2]Central Department of hydrology and Meteorology, Tribhuvan University, Kathmandu, Nepal
*Correspondence: 1)krishna.77572@iost.tu.edu.np2)nghimire077@gmail.com

Abstract

Global climate change has threatened both ecosystem functions and structures impacting vital ecosystem services and human well-being. Gandaki River Basin (GRB) is highly vulnerable to climate induced hazards. Climate change puts indigenous people at greater risk than others. Local and indigenous knowledge and skills as climate change adaptation actions are being used by Indigenous Local communities in and for various ecosystems in GRB. Nevertheless, because of their intimate knowledge of their land, indigenous peoples' traditional ecological knowledge could be the answer to fighting climate change. However, documentations are scanty and isolated to either out-scale or up-scale. Therefore, the gap was fulfilled through documentation of such knowledge and skills of indigenous communities of Gandaki River Basin of Nepal. The study adopted an analytical and consultative approach, examining both secondary data gathered through literature review and primary data collected through group discussions with six ethnic groups namely Tharu and Majhi communities of Chitwan; Brahmin/Chhetri communities of Dhading; Magar communities of Tanahun, Gurung and other mixed communities at Myagdi Thakali communities of Mustang and Gurung communities of Kaski, Nepal. Informal meetings, key informant interviews, and household questionnaires surveys were used following purposive sampling. The findings show that indigenous knowledge not only helps indigenous people cope with environmental and climate pressures, but also promotes socio-ecological system resilience. Ecosystem based Adaptation (EbA) practices was increasingly measured and traditional knowledge-based corresponded with the community-based adaptation initiatives.

***Keywords*: ** Climate change adaptation, Gandaki River Basin, Traditional ecological knowledge, resilience, Ecosystem-based adaptation.

Krishna Prasad Sigdel

Use of Indigenous and Traditional Knowledge (ITK) on Climate Change Adaptation at Gandaki River Basin of Nepal.

Presentation By

Krishna Prasad Sigdel, Ph.D. Scholar, Central Department of Botany, TU

Narayan Prasad Ghimire Ph.D. Central Department of Botany, TU,

Binod Dawadi Ph.D, Central Department of Hydrology and Meteorology, TU

Highlights of Presentation:

- Introduction: Climate Change
- Possible Future Effects of Climate change
- Recognition of Indigenous Traditional Knowledge (ITK)
- Objectives
- Approach and Methodology
- Study area: Gandaki River Basin
- Findings: Traditional knowledge and CC adaptation
- Discussion
- Conclusion and Recommendations
- Acknowledgement
- References

Introduction: Climate Change

- **Identifiable change in the climate of Earth** as a whole that lasts for an extended period of time (decades or longer)
  - When due to natural processes, it is usually referred to as global climate variability
  - Usually refers to changes forced by human activities that change the atmosphere

UNFCCC defines climate change as "**a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and observed over comparable time periods.**"

Possible Future Effects

Global Impacts

- Warming and **sea level rise** will continue and will probably occur more quickly than what we've already seen
- Even if **greenhouse gases are stabilized**, this will probably **continue to occur for centuries**
- Some effects may be permanent

Effects on Ecosystems

- **Wetlands, and other unique ecosystems** cannot handle higher temperatures well.
- **Forest fire** and other natural disasters will increase.
- Up to **30% of species** will be at increased risk or extinction due to the rapid changes in their ecosystems.

✓ Climate change is global in its causes but its consequences are far more reaching in developing countries, particularly mountainous country like Nepal.

- **Local or indigenous knowledge** refers to the cumulative and complex bodies of knowledge, know-how, practices and representations that are maintained and developed by **local communities**, who have long histories of interaction with the natural environment (UNESCO, 2012).
- Several studies have stressed the **pivotal role of ITK in climate change adaptation.**

Figure 2: Indigenous Knowledge in Climate Change Adaptation Policy Process

Adapted from Institute for Global Environmental Strategies, 2012

Recognition of Indigenous Traditional Knowledge (ITK)

ipcc
The Intergovernmental Panel on Climate Change

- Recognition of the significance of ITK for environmental challenges has only begun to emerge at the international level in the **last few decades**.
- The **IPCC Assessment (AR4, published in 2007**) noted that indigenous knowledge is "**an invaluable basis for developing adaptation and natural resource management strategies** in response to environmental and other forms of change".
- This was reaffirmed at the **32nd Session of the IPCC in 2010: "indigenous or traditional knowledge** may prove useful for understanding the potential of certain adaptation strategies that are cost-effective, participatory and sustainable".

Objectives:

- To study the level of understanding of **indigenous communities** and their knowledge regarding climate change impacts.
- Identify **traditional practices**, their utilization and adaptation and mitigation potential.
- To assess opportunities and constraints in **using traditional knowledge and practices** in **climate change adaptation** and resilience building.
- To capitalize on, develop, **expand and mainstream indigenous traditional knowledge climate change management.**



Approach and Methodology

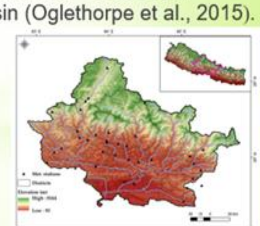
- Primary and secondary data collection
- Interactions with diverse groups of stakeholders conducted as follow:
  - *Observation
  - *Focus Group Discussions (FGDs)
  - *Key Informant Interviews (KIIs)
  - *Household surveys:
- Cross validation and triangulation of the data done.


Study Area: Gandaki River Basin (GRB) of Nepal

- **GRB** is one of the three river basins in Nepal with 32,057 km^2.
- **Marsyangdi, Daraudi, Seti, Madi, Kali Gandaki, Budi Gandaki and Trishuli** are the seven major tributaries of Gandaki river basin.
- It has great religious, agricultural, and socioeconomic importance, where **4.5 million people of different diversities inhabit** at this basin (Oglethorpe et al., 2015).

Major communities at GRB

Tharu, Majhi, Brahmin, Chhetri, Tamang, Sherpa, Darai, Magar, Thakali, Gurung and others....



Findings: Traditional knowledge and CC adaptation

Adaptation to address water shortages and damage

- **54% of the respondents** practiced **planting trees** in their **water storage areas;**
- **13% each respondents** water conservation and **rain water harvesting** and storage by using plastic ponds for domestic and irrigation uses.

Water management:

- **Use dry hey** to conserve moisture
- **Collect rainwater** from the roof and store in the tank for domestic use and water vegetables.
- **Construct ponds (plastic)** to collect rain and surface run-off water; and plant trees around water sources.

Traditional Knowledge and adaptation (Agriculture sector)

- **Migrate entire village** to low altitude areas to protect people and their animals from icy cold weather.
- Prepare **water ponds near seepage areas and springs** to tap water for irrigation.
- Plant seeds and seedlings are **covered with hey and water spraying** to conserve moisture.
- **Spray burnt out ashes** over vegetables to protect from insects.



Traditional Knowledge and adaptation (Agriculture/Seed preservation)

- **Alternate cropping patterns** with legume and non-legume crops.

- Make **Bhakari** and other containers made up of mud and bamboo **to store food grains** and placed at certain height from ground level **to protect from flood water.**

- **Paddy** are kept in sacks and hanged in ceilings; **garlics and maize cobs** in Jhotas or bunches are also **hanged tied to ceiling or wooden beam** of the houses.

Traditional Knowledge to Control Soil Erosion

- **Leaving crop residue on the field** is man age-old practice followed by the farmers. This type of mulch reduces raindrop impact, runoff velocity and increases infiltration rate.

- **Construct natural revetment and stone walls.**

- Trees and bamboo; **plantation around gullies and landslide areas.**

Traditional Knowledge and adaptation (Events and Disaster)

- Raised platform (**Chautara**) in the middle of the villages to be used as resting place for elders, travelers and to protect from extreme weather.

- Used **Chhatri** as extended hat during summer time to be safe from sun-burn.

- Ghurs (**Open fire**) are setup at home yard during winter season for heating.

Discussions

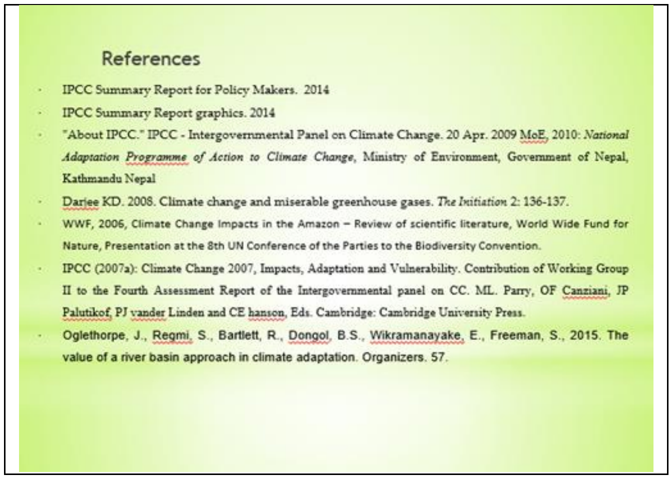
- **Respondents' perception and observed temperature data** validate the change in temperature and rainfall patterns.
- Indigenous Communities are active in using their **TK in ecosystem based adaptation** and in creating flood and landslide defense structure on vulnerable banks of streams and rivers
- Indigenous communities have **rich** traditional knowledge (TK) and are **custodian of this knowledge** especially regarding ecosystem based adaptation.
- More **training and awareness raising programs** are needed on disaster risk reduction, ecosystem based adaptation.
- **But the support is needed..**

Conclusion/Recommendation

- **Climate change is posing threat** to each and every aspects of development and wellbeing of human being;
- Communities are still using their traditional knowledge to protect their livelihood and settlements because scientific knowledge and technology is not available.
- There is a need to integrate indigenous traditional and scientific knowledge in ecosystem based adaptation;
- Indigenous Traditional knowledge (ITK) is fast vanishing because young generations not learning from elders.
- More inclusive research on exploration of traditional knowledge ecosystem based adaptation is needed.
- Traditional Knowledge Digital Library (TKDL) should be prepared at the national level to preserve TK by documenting them urgently.
- Need for protecting right of indigenous community and indigenous knowledge

Acknowledgement:

- Central Department of Environment, Botany, TU
- NAST/EBA-II for research fellowship
- Supervisors/Co-supervisors
- Local/Indigenous communities of the study areas.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Oglethorpe, J., Regmi, S., Bartlett, R., Dongol, B.S., Wikramanayake, E., Freeman, S., 2015. The value of a river basin approach in climate adaptation. Organizers. 57.

Spatial Representation of Bagmati River System using Benthic Macroinvertebrates in the Kathmandu Valley, Nepal

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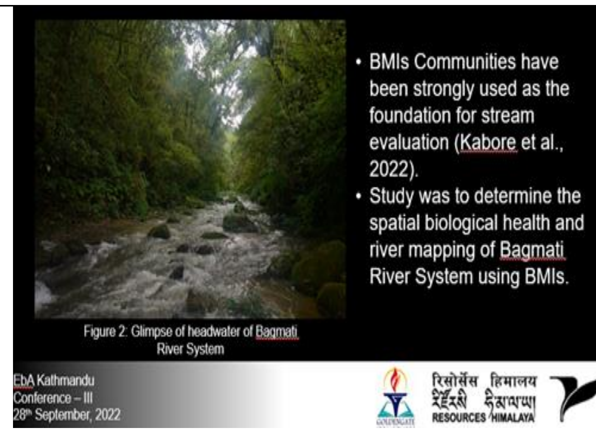
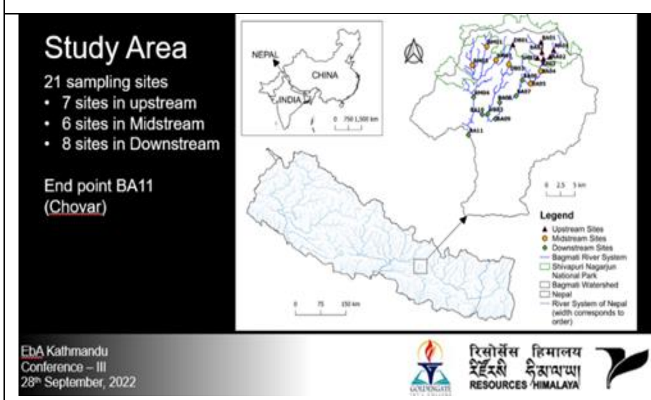
Abstract

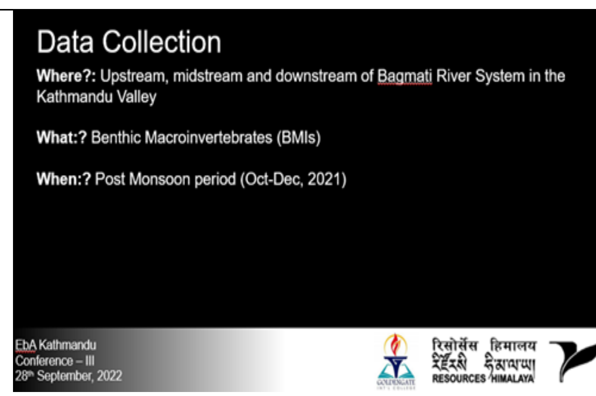
The existence of Nepal's holy river, Bagmati, which flows through the Kathmandu valley's core metropolitan, has been menaced by many anthropogenic threats. It is necessary to identify such stressors to restore them. This research focuses on determining river water quality to analyze the Bagmati River System's spatial biological health. Benthic macro invertebrates were used as biological indicators in this investigation. Benthic macro invertebrates were sampled from upstream to downstream using a multi-habitat sampling approach during the post-monsoon period (Oct-Dec, 2021). The Ganga River System Biotic Score/Average Score per Taxa (GRSBIOS/ASPT) was used to assess river water quality. From the sampling of 21 sites, a total of 5839 individual BMIs from 51 families and 11 orders were recorded. According to the findings, Gastropoda, Hirudinea, and Lepidoptera were found to be infrequent throughout the stretch, while Trichoptera was the dominant order followed by order Diptera. The distribution of species abundance throughout the stretch was not found normal ($p=2.439e-08$). Upstream was seen accounting for more than 30% of all the families, making upstream rich in taxonomic richness, which steadily decreased from midstream to downstream. The results show that facultative taxa are widely distributed in both upstream and midstream, but sensitive taxa are mostly found in upstream and in small numbers in the midstream. There are no signs that facultative and sensitive taxa exist in downstream. Downstream was fully dominated by pollution-tolerant species. According to classification performed using GRSBIOS/ASPT, the upstream river within Shivapuri Nagarjun National Park of the Bagmati River System are clean and are categorized as Class I, whereas rivers from the boundaries of the protected area to downstream are categorized as Class IV-V with few sites as Class II and Class III, indicating that they are extremely polluted. Water resource managers should utilize the study's findings to assess and restore the water's quality using biological indicators.

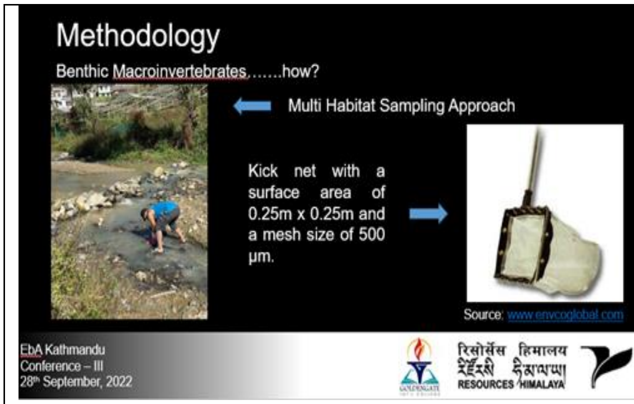
Keywords**:** Bagmati river system, Benthic macro invertebrates, GRSBIOS/ASPT, Kathmandu Valley, River water quality, Taxonomic Richness

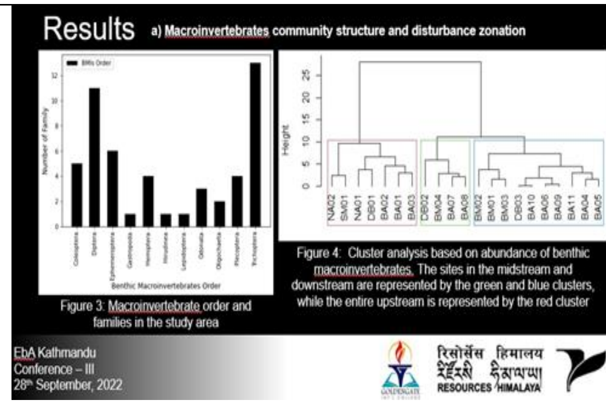
Pratik Shrestha








Methodology
Benthic Macroinvertebrates,…….how?
Multi Habitat Sampling Approach
Kick net with a surface area of 0.25m x 0.25m and a mesh size of 500 µm.
Source: www.envcoglobal.com
EbA Kathmandu
Conference – III
28th September, 2022
रिसोर्सेस हिमालय
RESOURCES HIMALAYA


Results a) Macroinvertebrates community structure and disturbance zonation
Figure 3: Macroinvertebrate order and families in the study area
Figure 4: Cluster analysis based on abundance of benthic macroinvertebrates. The sites in the midstream and downstream are represented by the green and blue clusters, while the entire upstream is represented by the red cluster
EbA Kathmandu
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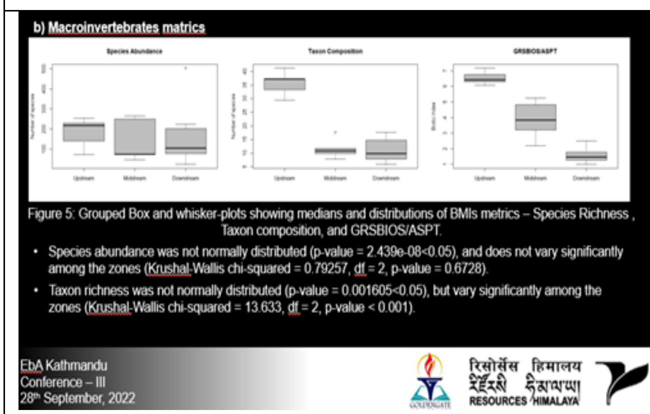
28th September, 2022
रिसोर्सेस हिमालय
RESOURCES HIMALAYA


b) Macroinvertebrates matrics
Species Abundance
Taxon Composition
GRSBIOS/ASPT
Figure 5: Grouped Box and whisker-plots showing medians and distributions of BMIs metrics – Species Richness , Taxon composition, and GRSBIOS/ASPT.
• Species abundance was not normally distributed (p-value = 2.439e-08<0.05), and does not vary significantly among the zones (Krushal-Wallis chi-squared = 0.79257, df = 2, p-value = 0.6728).
• Taxon richness was not normally distributed (p-value = 0.001605<0.05), but vary significantly among the zones (Krushal-Wallis chi-squared = 13.633, df = 2, p-value < 0.001).
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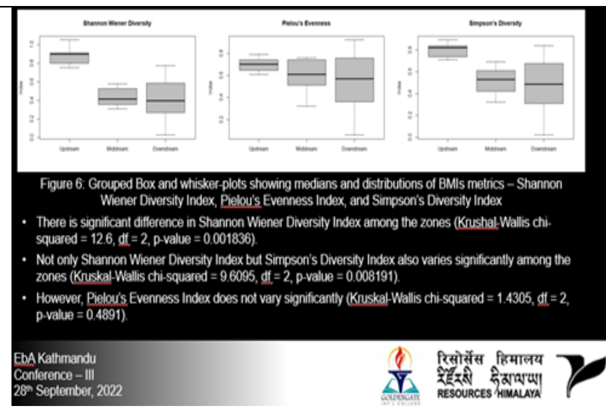
Shannon Wiener Diversity
Pielou's Evenness
Simpson's Diversity
Figure 6: Grouped Box and whisker-plots showing medians and distributions of BMIs metrics – Shannon Wiener Diversity Index, Pielou's Evenness Index, and Simpson's Diversity Index
• There is significant difference in Shannon Wiener Diversity Index among the zones (Krushal-Wallis chi-squared = 12.6, df = 2, p-value = 0.001836).
• Not only Shannon Wiener Diversity Index but Simpson's Diversity Index also varies significantly among the zones (Kruskal-Wallis chi-squared = 9.6095, df = 2, p-value = 0.008191).
• However, Pielou's Evenness Index does not vary significantly (Kruskal-Wallis chi-squared = 1.4305, df = 2, p-value = 0.4891).
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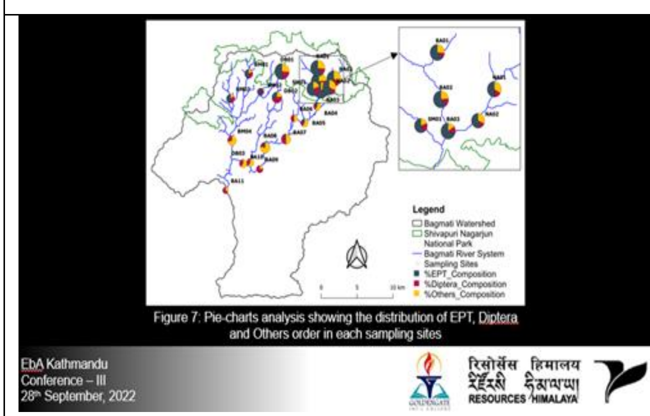
Legend
Bagmati Watershed
Shivapuri Nagarjun National Park
Bagmati River System
Sampling Sites
%EPT_Composition
%Diptera_Composition
%Others_Composition
Figure 7: Pie-charts analysis showing the distribution of EPT, Diptera and Others order in each sampling sites
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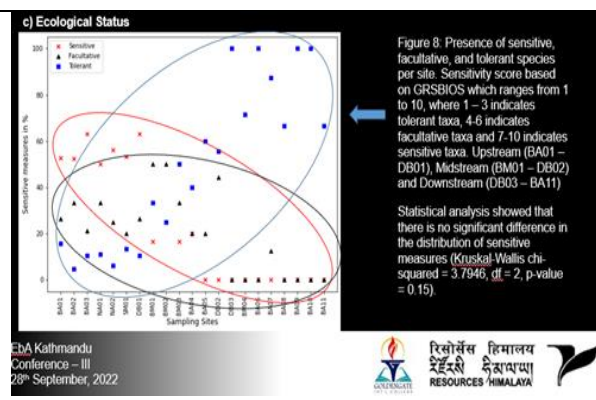
c) Ecological Status
Sensitive
Facultative
Tolerant
Sensitive measures in %
Sampling Sites
Figure 8: Presence of sensitive, facultative, and tolerant species per site. Sensitivity score based on GRSBIOS which ranges from 1 to 10, where 1 – 3 indicates tolerant taxa, 4-6 indicates facultative taxa and 7-10 indicates sensitive taxa. Upstream (BA01 – DB01), Midstream (BM01 – DB02) and Downstream (DB03 – BA11)
Statistical analysis showed that there is no significant difference in the distribution of sensitive measures (Kruskal-Wallis chi-squared = 3.7946, df = 2, p-value = 0.15).
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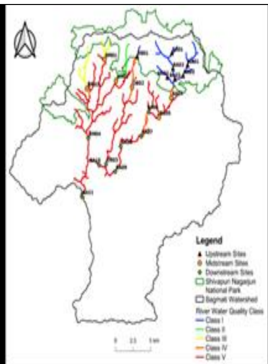

Figure 9: River Water Quality Mapping

Class I – Entire Upstream (BA01, BA02, BA03, NA01, NA02, SM01, DB01)
Class II – BM02
Class III – BM01, BM03
Class IV – BA04, BA07, DB02
Class V – Rest of all sites (BA05, DB03, BM04, BA06, BA08, BA09, BA10, BA11)

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Conclusion

- The study provides an overview of the current state of the Bagmati River System in the Kathmandu Valley.
- The river quality has degraded to such an extreme level making it unsuitable for any purposes, especially in the downstream.
- The upstream of this river system within Shivapuri Nagarjun National Park was found to be suitable for sustaining aquatic and terrestrial life, but as it runs out of the protected area and enters semi-urban and core areas, its quality showed decline eventually reaching an extremely contaminated level.
- Sensitive species that signal high quality are limited to upstream, whereas pollution tolerant species predominate downstream regions. . This indicates that downstream has reached a point where quality-determining species can no longer survive.
- The study also showed that benthic macroinvertebrates can be used as effective biological indicators of river environmental studies.

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Acknowledgement

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Drivers responsible for the changes in the ecosystem's services of Lal Bakaiya Watershed

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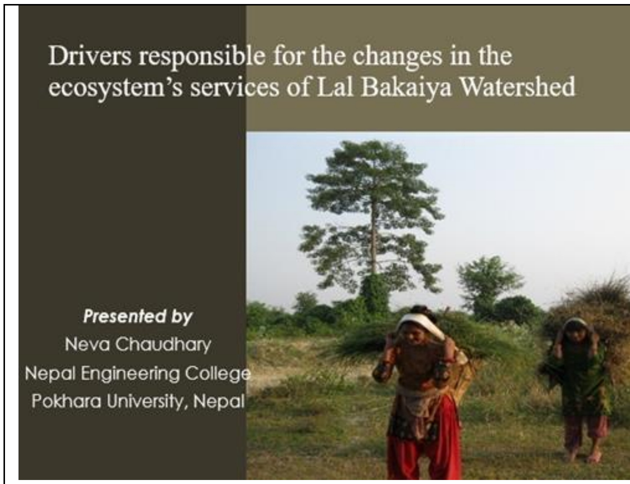
Abstract

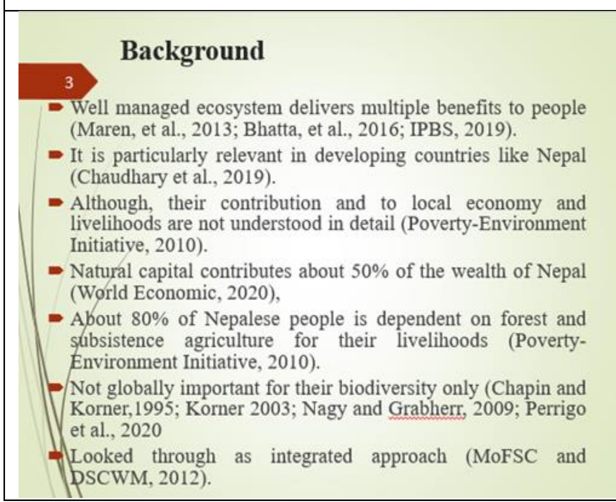
Watershed provides diverse range of ecosystem products and services supporting livelihoods of people. These products and services link to ecosystem health vis-à-vis their biodiversity. Contrarily, conservation and management of ecosystems and their biodiversity are often put at the backburner while developing socio-economic development plans. Consequently, ecosystem processes are disrupted and their products and services are negatively impacted, which has often farm reaching consequences to livelihoods of the people dependent on watershed based natural resources. This study was undertaken with the aim to map ecosystem services, the drivers of change and impact paths of the change drivers on the ecosystem services on one hand and the predominantly agriculturally based livelihoods of the people in Lal Bakaiya Watershed in ChureTarai landscape in eastern Tarai region of Nepal. Both qualitative and quantitative data were collected through household surveys, focus group discussions, key informant interviews and direct field observation. The study recorded a total 28 ecosystem services and showed high dependency of people on these services. Out of nine livelihood strategies people were highly dependent on six of them. People were mostly dependent on agriculture for their livelihood strategies. The study revealed that the status of provisioning services was decreasing compared to ten years ago. Deforestation, Riverbank erosion and fish poisoning were reported as the major direct drivers of change with impacts on ecosystem services and people's livelihoods. Significant reduction in availability of fish stocks and fodder was observed. However, availability of water for irrigation from Bakaiya River has key contribution toincrease the productivity of crops in the area. Contrarily, the farmers in the downstream area faced increasing constraints to irrigation due to depletion of water flow as well as deepening of river channel as a result of rampant extraction of riverbed, making the obstruction of river water for irrigation uses difficult for the farmers. Mapping of ecosystem services and change drivers responsible for degradation in the ecosystems pointed to the need of promoting friendly actions to maintain the Lal Bakaiya Watershed and the

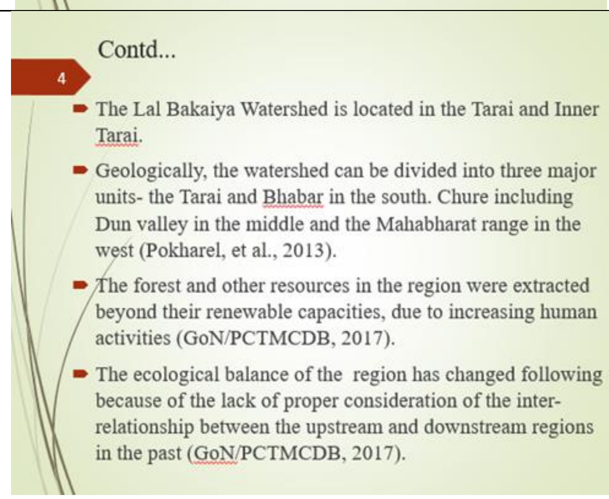
flow of services in order to sustain livelihoods dependent on terrestrial and aquatic ecosystems of the watershed.

Keywords**:** Biodiversity, Ecosystem services, Livelihoods, Watershed

<u>Neva Chaudhary</u>







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Problems and Objective

- Lal Bakaiya Watershed = survival and wellbeing of the people (Pokharel et al., 2013).
- However the services and resources are in degraded condition due to anthropogenic activities (MoFSC and DSCWM, 2012).
- It consists crucial biodiversity; however, information on particular area and their NR exploitation at the local level is much bounded.
- Precise information about the values and drivers of change is essential.
- The management of ecosystem services is only possible when the status of such ecosystem services are known.
- Objective is to identify and assess ecosystem services and the drivers of change of ecosystem services.

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Rationale of the study

Assessment of ecosystem services on spatial and temporal scale and particularly at the local level helps to evaluate the changes the ecosystem health and the services,

- The Lal Bakaiya Watershed has an ecological significances, values for society and the threats of degradation that the watershed faces.
- So, Knowledge on ecosystem services, drivers of change and subsequent impacts on livelihoods and wellbeing are key concerns that have triggered renewed concerns on ecosystem functions and services.
- The study contributes for conservation planning and management where ecosystem services were understanding in more detailed.

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Study area

- located in the central southern part of Nepal.
- total basin area = 868 km^2
- important for majority of the communities
- provides a diverse range of ecosystem services

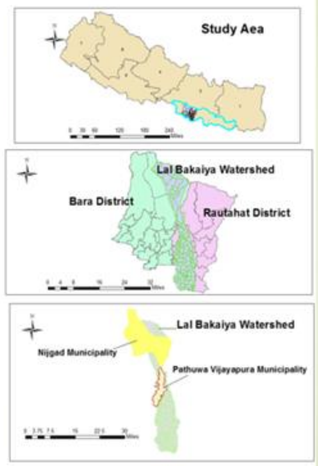

Figure Study Site

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Data Collection tools

A. Household survey
B. Focus group discussion
C. Key informant Interviews
D. Field observation

Result and Discussion

- Different kinds of ecosystems services provided by Lal Bakaiya Watershed.
- Total 27 ecosystem services were found.

Ecosystem services			
Provisioning (12)	Regulating (10)	Cultural (3)	Supporting (3)
Timber	Climate regulation	Spiritual and religious values	Habitat for flora and fauna
Fodder	Air purification	Aesthetic values	Nursery for fishes
Thatch	Flood control	Recreation	Soil formation and nutrient cycling
Livestock grazing	Erosion control		
Fuelwood	Pollination		
Wild edible plants	Siltation control		
Medicinal herbs	Water regulation		
Grasses	Pest regulation		
Fishes	Diseases regulation		
Water for drinking water	Carbon sequestration		
Water for irrigation			

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Ranking of ecosystem services

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Downstream	Upstream
Fuel wood	Irrigation
Irrigation	Fuel wood
Sand, gravel, stone	Fodder
Fish stock	Wild edible plants
Livestock grazing	Sand, gravel, stone
Fodder	Timber
Wild edible plants	Fish stock

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Sufficiency of provisioning services of downstream and upstream

- The status of ecosystem services (ES) was decreasing with comparison to 10 years ago.
- 94% respondents of downstream and 85% respondents of upstream suggested fuelwood is sufficient for current use only.
- Participants expressed due to insufficiency in fodder and grazing area there is direct impact on number of livestock.
- Low-income households are dependent on capture fishery for their livelihood.
- Most of the respondents of downstream were dependent on shallow tube well for the irrigation,
- However, 66% respondents of upstream were able to manage the water system.

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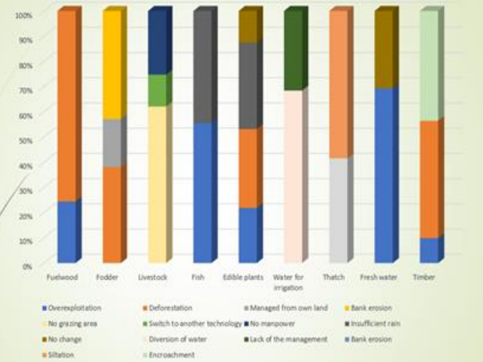
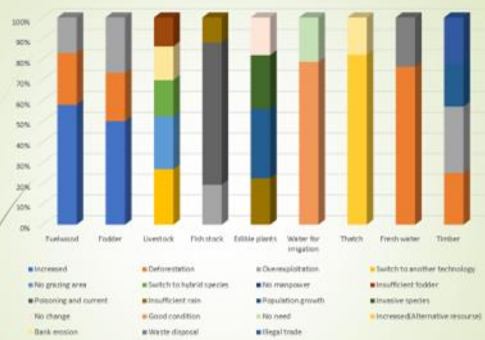


- Linkage between drivers of change and change in availability of ecosystem services, derived through household surveys (Downstream).

13



- Linkage between drivers of change and change in availability of ecosystem services, derived through household surveys (Upstream).

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Major Drivers of changes of provisioning services

- Overexploitation
- Deforestation
- Insufficient grazing area
- Fish poisoning
- Encroachment
- Riverbank erosion
- Siltation
- Switch to another technology
- Population growth

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- Impacts on ecosystem services derived through household surveys (Downstream)

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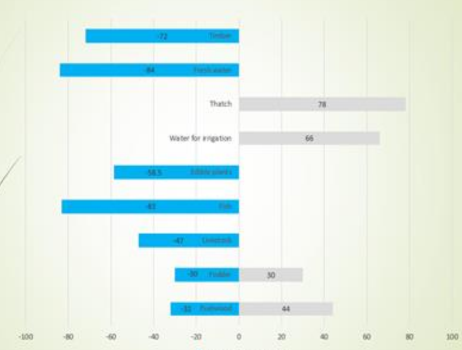

- Impacts on ecosystem services derived through household surveys (Upstream)

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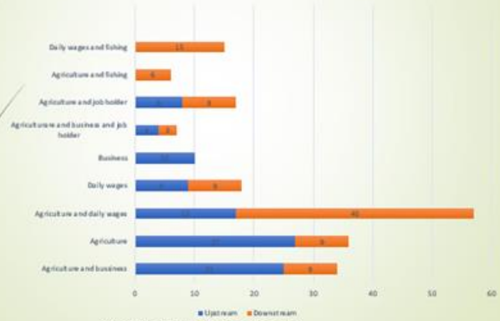
Livelihood strategies

Nine livelihood strategies

mostly dependent on agriculture

27% from Bara district and 9% from Rautahat district.



Livelihood strategies of locals

Conclusions and Recommendations

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Conclusions

- Lal Bakaiya Watershed is rich in ecosystem providing diverse ecosystem services, especially fuelwood, fish, irrigation to local communities for their livelihoods.
- The local peoples depend profoundly on the ecosystem services provided by the river for their subsistence and wellbeing.
- Therefore, any changes to flow of goods and services from forests had directly effect on agriculture practice and production.
- Deforestation, bank erosion, using poisoning for fishing, overexploitation was identified by the people as the major issues resulting in the degradation of forest ecosystem services

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Contd…

- Overall respondents noticed decline in fish stock because of some destructive fishing methods are in use in capture fishery, e.g. electric fishing, explosives and poisons.
- The policy makers should understand, identify and incorporate these values in their decisions for planning and investment of the Lal Bakaiya Watershed.
- For continuity of sustainable ecosystem services, awareness program should be initiated with participation and coordination of local communities and local government bodies.

Recommendations

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- The study has following recommendations:
- Since the fuelwood is still the major energy source, alternative source of energy should be provided on a subsidized basis to reduce energy dependency on forest.
- Promote alternative cooking energy options biogas, solar, improved cook stoves, production of charcoal briquettes from invasive plants, and so that it can reduces the rates of extraction of fuel wood from public and community forests
- Promote sustainable alternative livelihood options such as community-based fish farming (pond aquaculture) and other enterprise-based livelihood enhancing opportunities.

Contd…

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- Enhancing public awareness about the importance of forests and consequences of deforestation are also important to control deforestation.
- Based on natural resources availability, training need be provided to the local communities for income generation and economic benefit through sustainable utilization of local natural resources.

Photo plates

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Photo 1: Stored Fuelwood

Photo 2: Fodder collection

Photo 3: Destructive fishing practice

Photo 4: Sand, Gravel extraction from River bed

Lesson Learned from Mountain EbA: Lamjung, Rasuwa and Dolakha Districts

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Abstract

Nepalese communities are one of the most vulnerable people to climate change in south Asia. To adapt with the climate change impacts, GEF, United Nations Environment and National Development and Reform Commission of China-funded project entitled "Enhancing Capacity, Knowledge and Technology Support to Build Climate Resilience of Vulnerable Developing Countries" was implemented by the Ministry of Forests and Environment (MoFE) and supported by the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS) in Lamjung, Gorkha and Tanahu from 2013 to 2017. The implemented interventions i) climate resilient seedlings for reforestation and agro-forestry, ii) bamboo suckers and/or banana and salix seedlings on degraded river banks, and iii) seedlings/rhizomes/suckers in fruits orchards were monitored during/post interventions. A team from the Resources Himalaya Foundation (RHF) was involved to develop the monitoring and implemented protocol and assessed the EbA interventions through sampling and observations. The results were also shared with relevant stakeholders. Besides the production of monitoring reports, published policy brief, EbA newsletter and EbA M&I protocol and disseminated via conducting local and national workshops, presenting in conferences, and publishing articles.

Similarly, two cases studies on sustainable livelihood research were conducted in hilly districts i.e. Rasuwa and Dolakha in 2020. The research was focused to compare livelihood capital in EbA intervention and EbA non-intervention sites in both districts. These mountain EbA projects promote greenery as well as livelihood options to make climate-resilient communities. It needs to scale up or replicate similar interventions in other areas in coordination with development activities for sustaining EbA interventions.

Keywords**:** Climate Resilient, Livelihood Capital, Protocol, Sustainable

Bhumika Sunwar

Presentation Outline

- Mountain EbA in Nepal/ Monitoring of EbA in Lamjung
- Sustainable Livelihood survey in Rasuwa and Dolakha

Mountain EbA/Monitoring EbA

- After the pilot project in Panchase, Mountain EbA-II was implemented in Lamjung, Gorkha and Tanahu from 2013 to 2017
- GEF, United Nations Environment and National Development and Reform Commission of China-funded project "Enhancing Capacity, Knowledge and Technology Support to Build Climate Resilience of Vulnerable Developing Countries" was implemented by the Ministry of Forests and Environment and supported by the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS)

EbA Interventions and Methods

Key Interventions of the project were:

- Climate-resilient seedlings for reforestation and agroforestry,
- bamboo suckers and/or banana and salix seedlings on degraded river banks, and
- iii) seedlings/rhizomes/suckers in fruits orchards
- A monitoring and implementation protocol was developed and assessed the EbA interventions through sampling and observations.
- A team from RHF was involved in a rigorous field survey and analyzed the information

Outputs

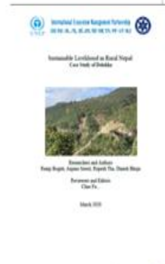
- Produced 3 monitoring reports
- Published EbA M&I protocols
- Shared monitoring results with local and national level stakeholders
- Presented an EbA Kathmandu conference-II and climate conference online

Publications for National and International Audience

- Translated into Nepali language and published a policy brief
- Published an article in springer

Sustainable Livelihood Survey in Rasuwa and Dolakha

- Conducted sustainable livelihood capital survey in Rasuwa and Dolakha in 2020
- Participants were EbA interventions and non-intervention households
- Produced two case study reports
- A Case study of Rasuwa is going to publish in the UNE Case study book.



Lesson Learned and Way Forward

Project Manager:

- Organizing site visit programs and sharing of experiences is important
- Coordination with development activities and
- issues in effectiveness and sustainability of EbA interventions.

Lesson Learned and Way Forward

Local actors/communities

- Enhanced knowledge of climate change adaptations in EbA interventions sites
- Still lacking action research in EbA towards nature-based solutions
- Need scaling up EbA interventions for the sustainability of EbA and making resilient communities

People's Livelihood Vulnerability to Climate Change in the Mid-hill Rural Settlement in Nepal

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Abstract

The local community perceived some changes in the Dhading district such as decreased in intensity, duration and frequency of rainfall and increase in annual temperature, drought duration, frost severity, incidence of disease and pest, decline in soil fertility, scarcity of water and severe frost/hailstones (Dahal et al., 2019). Therefore, this study was conducted whether these perceived changes are associated with climate vulnerability or not. So, this research was carried out to understand the livelihood vulnerability to climate change of people living in the rural areas in Galchhi Rural Municipality, Ward no. 5 Dhading, Nepal. Primary data were collected from household survey (purposive random sampling), interview with key informants, focus group discussion and direct observation. Secondary information were collected from the Department of Hydrology and Meteorology, journal, reports and climate change related in publications and the information were analyzed using MS Excel. The average annual rainfall data from 1991 to 2021 showed lowest rainfall in 2015 with 979 mm and highest rainfall in 1999 with 3025 mm. In the year 2020, total rainfall in study areas was 1560 mm, which was lower than year 2020. Mean annual maximum temperature was increasing at a rate of 0.034°C per year whereas mean annual minimum temperature data from 1991to 2021 was decreasing at the rate of 0.01°C per year. Livelihood of the households was found more vulnerable in terms of natural disasters and climate vulnerability and food. Sensitivity was highest followed by adaptive capacity and exposure. Knowingly and unknowingly, different adaptation practice was adapted by local households to cope with the impacts of climate change. Of the total, 71% of households introduced new variety within the same species, 51% of households introduce new varieties of new species for the adjustment of changing climatic scenarios and 18% of the total households practiced a mixed cropping farming system.

Keywords: Adaptation, Temperature and Precipitation Trend, Vulnerability Assessment

Shanti Tamang

Faculty of Forestry
Agriculture and Forestry University

PEOPLE'S LIVELIHOOD VULNERABILITY TO CLIMATE CHANGE IN THE MID-HILL RURAL SETTLEMENT IN NEPAL

A Case Study from Galchhi Rural Municipality, Ward No. 5, Bagmati Province, Nepal

M.Sc. FORESTRY THESIS PRESENTATION

Researcher

Ms. Shanti Tamang

M.Sc. Forestry 5th Semester, Roll No. FOS-33M-2018

Advisory Committee

Dinesh Raj Bhuju, PhD
Adjunct Professor

Balaram Prasad Sharma
Professor

August 2022

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PRESENTATION OUTLINE

- INTRODUCTION
- OBJECTIVES
- METHODOLOGY
- RESULTS & DISCUSSION
- CONCLUSION
- REFERENCES

2

INTRODUCTION

Nepal

- **4th** most vulnerable country due to the impacts of climate change and the net GHG emissions was 28,166.06 Gg CO_2-eq for the base year 2011 (MoFE, 2021).
- The average annual maximum temperature has **risen** by **0.056⁰C/year** (DHM, 2017).
- The average annual precipitation is **decreasing** at the rate of **−20 mm/year** in the last two decades (Subba et al., 2018).
- Nepal's agriculture relies upon summer monsoon rainfall that contributes 75% of total annual rainfall while **average** rainfall of Nepal is **1,700 mm/year** (DHM, 2017).

3

OBJECTIVES

General objective:

To assess people's livelihood vulnerability to climate change in mid-hills of central Nepal.

Specific objectives:

1. To assess the trends of temperature and precipitation in Galchhi area, central Nepal for the last 30 years
2. To examine the factors contributing to vulnerability of local people to climate change
3. To document the existing adaptation practices adopted by the local people for coping with the climate change.

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METHODOLOGY

Study area

Ward no. 5, Galchhi RM, Dhading district, Bagmati province.
Area: 21.79km²
Total household: 823

Selection criteria

- Area close to climate station.
- Households depending on agriculture.
- Area that has experienced drought.

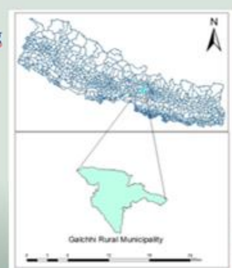

Fig. 1: Map of Study Area

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METHODOLOGY

Fig. 2: Household survey

Sampling Design:

Purposive sampling design.

Data Collection:

Primary as well as secondary data

1. Primary Data Collection

- Households were selected through purposive sampling methods considering sample units of 10% including the houses of different ethnicity. Participatory Rural Appraisal (PRA) tools and techniques were used to collect the necessary information as the primary data.

i) Household level questionnaire survey:

- 85 households survey was carried out to acquire state of households on components of livelihood.

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METHODOLOGY

ii) Key Informant Survey (KIS):

- Local leaders, local teachers, aged persons and supporting agencies.

iii) Focus Group Discussion:

- To gather information on past natural events in the area, observed environment changes in recent years, adaptation adapted by the local people (target group 7 to 10 people).
- 2 focus group discussions were conducted in whole study area.

iv) Direct observation:

- To observe and gather information on local social and physical features for getting insight view of aftermath of disasters and local practices on measures adopted by people to cope with drought.

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METHODOLOGY

2. Secondary Data Collection:

- Main source of secondary data were temperature and precipitation data of Dhunibesi climatological stations from DHM.
- DFO profiles and reports, Rural Municipality reports and reports of other line agencies.
- Related published and unpublished documents and literatures and journals.

Fig.3: Household survey

Fig. 4: Focus group discussion

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METHODOLOGY

Objective 1: Temperature and rainfall trend analysis

- Simple linear regression was used.
- Y=a+bt
- y= temperature or rainfall, t= time (year), 'a' and 'b' are constants.

Objective 2: Factors contributing to vulnerability of local people

Vulnerability factors were calculated (Hann et al., 2009).

$$LVI_c = \frac{W_{sdp}SDP_c + W_{ls}LS_c + W_{sn}SN_c + W_hH_c + W_fF_c + W_vW_c + W_{nd}ND_c + W_{cv}CV_c}{W_{sdp} + W_{ls} + W_{sn} + W_f + W_v + W_{nd} + W_{cv}}$$

9

METHODOLOGY

Objective 3: Documentation of adaptation practice

- The data were collected through the household survey.

- The collected data were processed and analyzed using MS-Excel.
- Different tables prepared and displayed as percentage, bar diagram and pie chart.

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RESULTS & DISCUSSION

Objective 1: Temperature and Precipitation Trend

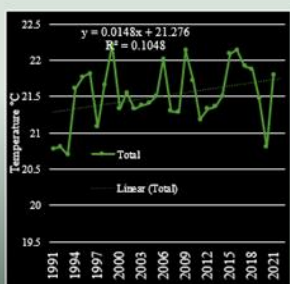

Fig. 13: Mean annual average temperature of Galchhi, Dhading

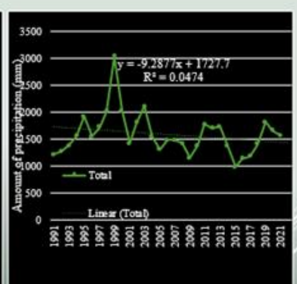

Fig. 14: Annual amount of precipitation (mm) of Galchhi, Dhading

Source: DHM, 2021

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RESULTS & DISCUSSION

Objective 1: Temperature and Precipitation Trend

- A study carried out by Paudyal et al. (2015) in Salyantar of Dhading district covering the years from 1979 to 2008 showed that maximum temperature was increasing at the rate of 0.03°C/year and the trend of minimum temperature showed that the trend was nearly constant with the increment.
- The average annual trend of precipitation was found to be decreasing at the rate of 1.85 mm/year which was similar to the present study (Paudyal et al., 2015).

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RESULTS & DISCUSSION

Objective 2: Vulnerability factors

Table 1: Component values of vulnerability contributing factors of study area

Major components	Value
Socio-demographic value	0.288
Livelihood strategies	0.31
Social networks	0.466
Health	0.31
Food	0.504
Water	0.19
Natural disaster and climate vulnerability	0.57

Fig. 16: Vulnerability spider diagram of major components

Source: Field survey, 2021

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RESULTS & DISCUSSION

Objective 2: Vulnerability factors

Table 1: LVI-IPCC contributing factor

IPCC contributing factors	
Adaptive capacity	0.1
Sensitivity	0.11
Exposure	0.095
LVI-IPCC	-0.0005

➤**Moderately vulnerable category**

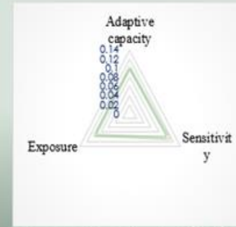

Fig. 17: Vulnerability triangle of LVI-IPCC

Source: Field survey, 2021

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RESULTS & DISCUSSION

Objective 2: Vulnerability factors

- In the mid-hills, drying up of water springs has caused water scarcity even more pronounced particularly in dry seasons.
- Water component indices was found to be 0.11 as locals have to walk for an hour to fetch drinking water and that the availability of water source is inconsistent (Panthi et al., 2014).
- The livelihood vulnerability index (LVI) by Hahn and LVI-IPCC of Dhading district were analyzed by Panthi et al. (2014) and found to be -0.0767 similar to the finding of my study

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RESULTS & DISCUSSION

Objective 3 : Documentation of adaptation measures

Table 2: Major adaptation practice applied at Galchhi, Dhading

Impact on	Adaptation measures	Respondent	Responses	%
Agriculture	Introduce new variety within same species	85	60	71
	Introduce new variety of new species	85	43	51
	Mixed cropping	85	15	18
	Green house technology	85	0	0
	Use of organic pesticides	85	2	2
	Terracing	85	3	4
	Zero tillage/minimum tillage practice	85	0	0

Source: Field survey, 2021

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RESULTS & DISCUSSION

Objective 3: Documentation of adaptation measures

Table 3: Major adaptation practice applied at Galchhi, Dhading

Impact on	Adaptation measures	Respondent	Responses	%
Water resources	Rain water harvesting	85	12	17
	Rotational irrigation	85	0	0
	Sprinkles irrigation	85	5	6
	Drip irrigation	85	0	0
Others	Plantation	85	6	7
	Out migration	85	56	66

Source: Field survey, 2021

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RESULTS & DISCUSSION

Objective 3: Documentation of adaptation measures

- Sudedi et al. (2018) showed that as an adaptation, people shift from traditional farming practice to vegetable farming, waged labor and employment outside country and off-farm business due to insecurity in agriculture and less availability of pasture land.
- The result of the logistic model as the study carried out by Tiwari et al. (2014) showed that adaptation practice is significantly influenced by farm size (Bari land), family members available for farming, farm income, food sufficiency from farm, and membership in the CDG and use of credit.
- Among the commonly cultivated crops, rice, buckwheat, soybean, foxtail millet, and mango have higher genetic diversity than other crops (MoAD, 2017).

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CONCLUSIONS

- There was increasing trend in mean annual average temperature and decrease trend in amount of precipitation.
- Livelihood of the household is more vulnerable in terms of natural disaster and climate vulnerability and food. Sensitivity is highest followed by adaptive capacity and exposure.
- Different adaptation practice were observed in local households to cope with the impacts of climate change. 71% household introduced new variety within same species, 51% household introduce new variety of new species for the adjustment of changing climatic scenario and 18% of the total households practiced the mixed cropping farming system.

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PANEL DISCUSSION

Theme: Integrating EbA Knowledge in Policy Formulation

<u>First round</u>:

In the first round, the moderator raised specific issues to individual panelists.

The moderator requested Mr. Bhattarai to talk about the current situation of Panchase, its overall ownership journey and the way the new government has adapted the EbA concept.

Mr. Dil Bahadur Bhattarai, who was directly involved in the pilot project on EbA in Panchase of Nepal, talked about the journey of EbA at local and policy level. He gave a brief overview on the rich biodiversity of the region that houses more than 600 species of trees and other endangered species. The area is also comprised of 143 species of Sunakhari (Orchid) and among them two species is only found in the Panchase area. He further focused on the geography of the region consisting of mountains as the source of Fewa Lake and many other rivers. Because of the dependency of more than 65,000 people on the resources in the region and its high potential for eco-tourism, the place needs to be conserved. He explained how the EbA planning of Panchase mountain ecological region became a success through the incorporation of livelihood in conservation.He pointed out that for the success of EbA, awareness campaign and capacity building is required at community level. In addition, people have a huge dependency on ecosystem services for their livelihood. He exemplified that the water and soil conservation practices were created in a way that boosted the economy of the villagers through amriso plantation and tea and coffee production. Additionally, similar to the ancient times, Chautari and ponds establishment were prioritized with the help of local bodies and Pokhara Municipality who allocated fourteen lakh rupees for pond creation, which has a direct impact on eco-tourism through recreational activities like boating. The incorporation of local bodies like "Aamasamuha" and "Yuvasamuha" is also important factor for the success of EbA activities. He highlighted that in the current situation, the community are clearly familiar with the term "EbA", the endangered species has been preserved, the livelihood of the community has been promoted through home stay and ecotourism, the water sources has been conserved, reservoirs has been created for irrigation, and budget has been allocated for the Panchase Conservation Area. He concluded by saying that effective activities of EbA should be promoted and since the people who led in the first phase are the local governmental representatives, the continuation of activities in the region has been easier.

As a representative of the donor organization (UNDP) of EbA, Mr. Rai was asked to respond whether the funds allocated had been rightfully utilized.

Mr. Yalambar Rai talked about whether the funds allocated for EbA has were rightfully used. He mentioned that the Conference of Parties (COP) of 2010 had approved of EbA and stressed that the Panchase project was also one of the pilot project for UNDP. He gave an overview on the different level of interest from different organizations like IUCN who was more focused at local level, UNDP who was more interested in biodiversity conservation and UNEP who was attentive to climate change and EbA at policy level. Talking about the use of the finds, he highlighted that there was maximum utilization of the allocated resources in two years of the project period. He discussed that EbA should be linked with human wellbeing in two aspects: climate resilience and livelihood supportive interventions. Collaboration with the governmental agencies was also carried out and Panchase Management Council was formed at the local level. Furthermore, there were capacity building and training was given to the Community Forests User Groups. In order to familiarize people with EbA, field level activities were carried out before initiating the project; He highlighted the strong case made by the pilot project which encompasses 17 locations within 4 watersheds. As a result, overall success was well documented and the local level people were made aware about EbA and its benefits. Even with the huge success, he pointed out towards the necessity of linking EbA with the market through market-based tools and green economy. He concluded by pointing that stability and leadership from government also has a significant role.

The moderator requested Dr. Devkota to give some insights of how the documented knowledge on EbA has been disseminated and whether the knowledge has been addresses in the policy level.

Dr. Bimala Devkota highlighted that the main objective of NCCKMC is generation of knowledge of climate change as well as its dissemination. In order to promote the knowledge of climate change among young generation, NCCKMC collaborated with Climate Knowledge Development Network (CKDN) in a project in which 25 young researchers were granted for research in the Mansalu Conservation Area. Furthermore, in coordination with UNDP, Climate

Risk Management Tool Kits were developed for local level awareness and targeted to general people including decision makers at district and community level, students, and mass-media outlets. Additionally protocols were created to mainstream the idea and resources at the local level. Furthermore, NCCKMC partnered with ADB to provide research grant up to 50 million NPRto senior researchers, which helped to gather lower to higher level knowledge input. As a result, among 36 selected researches, 32 of them were published in high impact factor journals, as a significant achievement. The research provided benefits to many students as well. NCCKMC is still working on promotion of climate change knowledge such that for EbA II, 40 grants has been allocated of which 22 grants has already been released and 18 will be granted in the near future, which will help to build capacity for the young researchers. They are even working on policy dialogues, community level workshop and are also focusing on school level awareness on EbA. She highlighted about the "Climate Development Portal" developed by NCCKMC that helps in sharing and dissemination of knowledge related to climate change and also requested researchers to upload knowledge in the portal so that young researchers have easier access to current research.

The moderator asked Mr. Timala to give the perspective of the government on the level of satisfaction on the overall journey of EbA in Nepal.

Mr. Gauri Shankar Timala was the DG of DOF-MOFE during the period that the EbA was introduced in Nepal. He discussed how the EbA came about and why it is important for mountain countries like Nepal. In the context of Nepal, EbA was introduced as a pilot project Panchase in 2011 after the representatives of COP became aware about EbA and the donors developed interest in Nepal. At first, the knowledge about EbA was limited to intellectuals only, so it was necessary to mainstream the idea at local level which could be achieve through training manual for awareness at local level. Before starting the project, questions on the site selection was raised and once Panchase was selected, there were various other activities carried out before the initiation of the project.Panchase Cost Benefit Analysis, Case studies for planation (Amriso, Timur), vulnerability and impact assessment, and baseline social and natural resource survey were carried out. The dissemination was carried out through awareness campaign and publicity in news channels with the help of national and local level reporters and journalists. The intensive work carried out provided benefits at the policy level as well such that "Climate Policy" was added in Forest policy 2015 and EbA was incorporated in Strategy of Forest Conservation which can be considered a huge achievement in the context of Nepal. He pointed out that since EbA II is on the way, the completion of EbA I paved the way for other climate change adaptation. He gave an example of the popularity of EbA by comparing it with the status of Community Forests since EbA is also taking a similar route regarding popularity among researchers and students.

Second round:

The second round consisted of a common question to all the panelists. Giving an overview on the Conference of Parties (COP) and Nepal's representation, the moderator raised the question on the stand of Nepal's issue in COP26. She further pointed out if Nepal is being seriously heard and also requested to tell about the things that we have missed to present in the international platform.

Mr. Dil Bahadur Bhattarai gave a brief response to the raised question. He pointed out that it is very necessary to evaluate the achievement that Nepal has received in the international platform like COP. He highlighted that the government need to focus on the relevant and burning issues that has been affecting the people in Nepal and present our concerns in the same manner.

Mr. Yalambar Rai talked about the various activities that are carried out in such international platform and appreciated the innovative ideas and exercises which are carried out in the side events. In the context of mountainous countries, ICIMOD usually creates an agenda and discusses in one of the major discussions. As for Nepal, he pointed that the readiness and priority of government is important and according to him, it is high time that the government prioritize adaptation. While talking about climate change, some of the things that come up in discussions are mitigation, adaption, loss and damage, and climate finance. He discussed that mitigation might not be much important for Nepal as we are not the contributor of climate change, climate financing aspect could be important as Nepal has targeted to become carbon neutral by 2050. Even in COP26, Nepal openly expressed its emergency while the discussions of "Climate Emergency" were being carried out. He expressed that while talking about climate change in such forum, agendas relating to economic loss and damage should be raised and discussed by Nepal. One of the limitations is that there is no effective transfer of information about negotiation in international forum which is exacerbated by the unstable government in Nepal.

Such international forums are not utilized properly, and benefits are not maximized. He stressed that how we present our position is the determinant of what we gain. He concluded by saying that it is necessary to link policy and academia so that the real issues are discussed properly and there is a meaningful presence of our country in the international platform.

Mr. Gauri Shankar Timila pointed out that that the issues to be discussed in the international forum are first passed through the committee created by Nepal Government and then presented in COP. He believes that it is important to understand how many the requirements or issues are influenced by the representatives in the forum. One of the prime things to understand is that it is necessary to develop the interests of other countries in the forum since impressive presentations are known to be perceived really well. The delegates who represent the country in COP are mainly the people of climate related projects and governmental secretaries, so their presence should be impactful. He explained how the exposure in forum could be beneficial by giving example of the 10^{th} Community Based Adaptation Conference (CBA10) which happened in Bangladesh where Nepal presented about EbA in the country. The impact was so vast that in CBA11, an individual session was dedicated to EbA. Therefore, he stressed on the need on impactful presence for which serious planning should be carried out through pre-discussion on the issues before going to the forum. Considering that Nepal’s issues seem to be unheard, he mentions the possibility of limited openness during the process of selecting representatives in the forums.

Dr. Bimala Devkota basically talked about the possibility of impactful presentation in the upcoming COP27. She said that being a governmental body, NAST has been involving in the technical committee in the agenda preparation for COP. However, this year, NAST has not been involved in the committee in any way. Even though NAST has been working in the preparation phase of COP, they have no experience of representing in any COP. She kept her response short by expressing hope that the necessary agendas will be presented well in the upcoming COP27.

Valedictory Remark: Way Forward

Dr. Usha Jha started by appreciating the effort of the conference. She highlighted that EbA is a part of our system. In the 15^{th} plan of the National Planning Commission, climate change was mentioned as a very serious issue. According to her, the policy makers in Nepal are experienced enough to develop policies required for various issues but it entirely depends on how much they are interested to work on it. A good working environment is essential to work on such important policies; however, there are some loopholes in the working system. In addition, strategical planning and discussions are not thought out properly. She highlighted the situation of representation in international platforms. She explicitly mentioned that ministers are not capable to advocate on climate issues and as observed, our advocacy is lacking in the international platform as the requirements are not discussed well. The main reason behind this is that the one who knows the issues clearly do not get the chance to represent. While discussing about such international forum, government has development a series of steps but the processes within the steps are questionable. She raised the importance of resiliency by explaining the need of system resiliency at policy level and need of ecosystem resiliency to encompass all the conservation aspects. For a successful outcome, an integrated approach is required. She applauded the activities Panchase which shows a very innovative integration. She also admired the EbA conference which could incorporate multistakeholder view in the panel discussion. For multifaceted projects like EbA, sustainability should go in parallel so that the future is ensured and such projects can be replicated in other areas. She also emphasized that EbA programs should not be discussed only at policy level, but its functionality should be made clear to the community level because these are very high-sounding programs. The contribution of such projects will be in development and teaching the new generation of young researchers. She underlined that it is important to consider how one can adapt to the resilient ecosystem. So, such ideas and processes need to be internalized.

Vote of Thanks

Ms. Anu Adhikari highlighted the importance of the EbA, which is an approach required by the country. She expressed her gratitude to each and every personnel involved directly and indirectly in the conference. She started by thanking the opening chair Dr. Dinesh Raj Bhuju, chief guest Dr. Shilu Manandhar Bajracharya and guest speaker for the featured talk Emeritus Prof. Dr. Ram Prasad Chaudhary. She continued to thank other guests who provided the remarks which included Dr. Narendra Babu Man Pradhan, Dr. Chhatra Mani Sharma and Dr. Buddhi Sagar Poudel. She expresses her gratitude to the technical session chairs Prof. Dr. Kedar Rijal and Prof. Dr. Khem Poudel and moderators Dr. Nani Sukhaju and Dr. Ramdevi Tachamo Shah. After thanking the presenters, she moved on to thank the speakers of panel discussion, Mr. Gaurishankhar Timala, Dr. Bimala Devkota, Mr. Yalamber Rai, and Mr. Dil Bahadur Bhattarai as well as the facilitator Dr. Meena Bohara. Finally, she extends her thanks to Dr. Usha Jha for her valedictory remarks providing way forward. She also expressed her acknowledgement to the rapporteurs, conference secretary, and volunteers who were involved in the successful completion of the conference. Lastly, she concluded by saying “Let’s take EbA conference to an international level. Why not Nepal takes the initiative? “

EbA Kathmandu Conference 2022

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A-D. Some glimpses of the conference