ICIMOD Workshop Report

Kangchenjunga Landscape Conservation and Development Initiative (KLCDI)

ICIMOD

FOR MOUNTAINS AND PEOPLE

Workshop Report

Regional Orientation on Long Term Environmental and Socio-ecological Monitoring

Institute of Forestry

About ICIMOD

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

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ICIMOD Workshop Report

Kangchenjunga Landscape Conservation and Development Initiative (KLCDI)

Regional Orientation on Long Term Environmental and Socio-ecological Monitoring

14–18 November 2016, Pokhara, Nepal

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Contents

Acronyms and Abbreviations

ATREE	Ashoka Trust for Research in Ecology and the Environment
CAS	Chinese Academy of Sciences
CDS	Conservation and Development Strategy
CFUG	community forest user group
CIB	Chengdu Institute of Biology
ComForM	Community-based Forest Management in the Himalaya
DFRS	Department of Forest Research and Survey
FRA	Forest Resource Assessment
GBPNIHESD	G.B. Pant National Institute of Himalayan Environment and Sustainable Development
GIZ	Gesellschaft für Internationale Zusammenarbeit
GLORIA	Global Observation Research Initiative in Alpine Environments
GPR	ground-penetrating radar
HI-LIFE	Landscape Initiative for Far Eastern Himalayas
HKH	Hindu Kush Himalaya
HKPL	Hindu Kush Karakoram Pamir Landscape
ICIMOD	International Centre for Integrated Mountain Development
IoF	Institute of Forestry
IPCC	Intergovernmental Panel on Climate Change
KL	Kangchenjunga Landscape
KLCDI	Kangchenjunga Landscape Conservation and Development Initiative
KM&C	Knowledge Management and Communication
KSL	Kailash Sacred Landscape
KSLCDI	Kailash Sacred Landscape Conservation and Development Initiative
LTESM	long term environmental and socio-ecological monitoring
MoFSC	Ministry of Forests and Soil Conservation
PRA	participatory rural appraisal
PSP	permanent sample plot
RECAST	Research Centre for Applied Science and Technology
RPN	Red Panda Network
TMI	The Mountain Institute
TU	Tribhuvan University
WCD	Wildlife Conservation Division
WII	Wildlife Institute of India

Summary

A regional orientation on long-term environmental and socio-ecological monitoring (LTESM) for transboundary landscapes in the Hindu Kush Himalaya (HKH) was conducted in Pokhara, Nepal, by International Centre for Integrated Mountain Development (ICIMOD) and Institute of Forestry (IoF)/ Tribhuvan University (TU) from 14 to 18 November 2016. Forty-eight participants representing four countries in the HKH — Bhutan, China, India, and Nepal — and four transboundary landscapes — Kangchenjunga Landscape (KL), Kailash Sacred Landscape (KSL), Landscape Initiative for Far Eastern Himalayas (Hi-LIFE), and Hindu Kush Karakoram Pamir Landscape (HKPL) — attended the workshop. The workshop objectives were to strengthen the capacity of partner institutions on LTESM and to develop a road map for conducting LTESM of priority ecosystems in transboundary landscapes. By bringing together relevant institutions from all KL member countries — Bhutan, India, and Nepal — this workshop also provided an opportunity to finalize and endorse the first two-year Knowledge Management and Community (KM&C) Strategy for Kangchenjunga Landscape Conservation and Development Initiative (KLCDI) — the KLCDI KM&C Strategy 2016–18.

During the workshop, key elements of the LTESM Framework (Chettri et al. 2015) were presented, and participants shared their experiences and preliminary results of environmental and socio-ecological monitoring in the HKH. These included:

- socio-ecological forest monitoring along an altitudinal gradient in Nepal (IoF)
- grassland and peatland monitoring in China (Chengdu Institute of Botany, Chinese Academy of Sciences)
- alpine vegetation responses to climate change using the GLORIA methodology (Central Department of Botany, TU)
- glacier monitoring in the Himalaya (ICIMOD)
- community-based red panda monitoring in eastern Nepal (Red Panda Network)
- monitoring Nepal's forest resources using permanent sample plots (Department of Forest Research and Survey, Ministry of Forests and Soil Conservation)
- long-term socio-ecological monitoring of rangelands in the Qilian Mountains of China (Lanzhou University/ ICIMOD)

From the Kailash Sacred Landscape, recent experiences were shared by partner institutions on

- forest socio-ecological monitoring (Research Centre for Applied Science and Technology, TU)
- wildlife monitoring (Wildlife Institute of India)
- springs monitoring (ICIMOD)

A technical session was also conducted to build participants' capacity on monitoring gender and socio-economy in LTESM, governance and institutions in ecosystem management, and participatory approaches in LTESM.

During the workshop, key monitoring indicators based on four parameters — ecosystems, livelihoods (socio-economy and gender), climate change, and policy and governance — in four major ecosystems — rivers and wetlands, forests, grasslands, and agro-ecosystems — were agreed upon. Based on these indicators, road maps for LTESM were developed for KL, Hi-LIFE and HKPL, with special focus on the KL. These road maps will be further refined and finalized in 2017 with the aim of developing an LTESM manual in 2018.

During this workshop, the KLCDI KM&C Strategy 2016–18 was finalized and endorsed by KL partners from Bhutan, India, and Nepal. The Strategy is a working document for effective and structured planning and monitoring of communication priorities through 2018. The successful endorsement of the Strategy proved the acceptance and need for structured communication in the KL. The KLCDI KM&C Strategy will be monitored every six months by the ICIMOD KLCDI team to ensure focus on priority communication instruments to be implemented.

Background

The Kangchenjunga Landscape Conservation and Development Initiative is being implemented through the Ministry of Agriculture and Forests, Royal Government of Bhutan; G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD), Ministry of Environment, Forests and Climate Change, Government of India; and Ministry of Forests and Soil Conservation (MoFSC), Government of Nepal. The program aims to improve sustainable and inclusive ecosystem management in the Kangchenjunga Landscape for enhanced and equitable livelihood benefits, contributing to regional and global conservation agendas through regional cooperation. One of the initiative's major outcomes is to strengthen local and national mechanisms and capacity for long-term environmental and socio-ecological monitoring in the landscape (Implementation Plan 2016–20). This will fill the data gap in the HKH region identified by the IPCC's AR4 report, while also supporting the monitoring of impacts and changes in biodiversity conservation and sustainable development resulting from the program. Therefore, the Regional Orientation on LTESM was organized by International Centre for Integrated Mountain Development (ICIMOD) and the Institute of Forestry (IoF)/Tribhuvan University (TU) with the objectives and expected outputs given below.

Workshop Objectives and Expected Outputs

In the long term, one of the main objectives of KLCDI is to work towards an agreement of all partners on standard protocols for long-term monitoring and data sharing mechanisms. Working towards this goal, the objective of the regional LTESM workshop was to strengthen the capacity of partner institutions regarding long-term environmental and socio-ecological monitoring.

This regional workshop brought together the relevant institutions from all KL member countries — Bhutan, India, and Nepal — and provided an opportunity to finalize and endorse the first two-year KLCDI Knowledge Management and Communication Strategy (KLCDI KM&C Strategy 2016–18) within parallel/additional workshop sessions.

The three expected outputs of the regional workshop were:

- Built and improved capacities of participants on methodologies for long-term socio-ecological monitoring in transboundary landscapes; creating an exchange platform for scientists (social and natural sciences) and policy makers working on long-term monitoring all over the Himalaya
- A road map for conducting LTESM of priority ecosystems in the transboundary landscapes
- A finalized and endorsed KLCDI Knowledge Management and Communication Strategy (2016–18)

Day 1: Monday, 14 November 2016

Inaugural Session

Chair: Prof. Dr Tirth Raj Khaniya, Vice Chancellor, Tribhuvan University

Welcome address

Prof. Dr Krishna Raj Tiwari, Dean, IoF, TU, gave a warm welcome to all participants and thanked them for their attendance. He expressed his confidence that the workshop would be helpful for collective learning and sharing of experiences in a broader spectrum. He highlighted that the workshop could potentially play a crucial role in improving the management of natural resources and fostering the mitigation of and adaptation to climate change. He concluded by wishing all participants a successful workshop in Pokhara.

Transboundary landscapes program: opportunities and challenges for mainstreaming LTESM

Dr Nakul Chettri, Program Coordinator, KLCDI, ICIMOD, started by highlighting the importance of the partnership between ICIMOD and IoF leading to this regional workshop. He emphasized that with the changing global situation, multidiscipline as well as new integrated approaches have become more important, and called for more collaboration towards a socio-ecological approach. He then informed participants that the HKH is data deficit in the IPCC's AR4 and AR5 reports, thus there is a strong need for long-term data in the region. After this introduction, Dr Chettri presented ICIMOD's transboundary landscapes approach in general, as well as the six initiatives implemented within the program: Cherrapunjee-Chittagong, Kailash, Hindu Kush Karakoram Pamir, Kangchenjunga, Hi-LIFE, and REDD+. He concluded by presenting the workshop objectives and expected outputs, with support from Ms Heike Junger-Sharma, who oriented participants on the daily workshop program.

Remarks from India

Dr Hemant Kumar Badola, Scientist F and Scientist in-charge, GBPNIHESD, Sikkim Unit, India, remarked on the high priority of LTESM and the relevance of this workshop. He provided a short review of achievements since 2002 in the Indian context of the Kangchenjunga Landscape. He noted that despite many challenges, a consensus was built between various partners in the landscape and a five-year plan for KLCDI was prepared. He appreciated the support and cooperation received from ICIMOD in these achievements. Dr Badola concluded with wishes for an effective workshop to bring the expected outputs.

Remarks from Nepal

Prof. Dr Ram Prasad Chaudhary, Professor Emeritus, TU, Nepal, thanked ICIMOD, GIZ, and all other partners involved in the workshop. He highlighted the value of the HKH as one of the richest areas in biodiversity, but with the inclusion of social issues, such as poverty, he argued for an integrated approach that aims at a socio-ecological understanding to narrow down issues and to ensure biodiversity and livelihoods are safeguarded at the same time. He concluded by stressing the importance of long-term data in order to achieve this.

Remarks from Bhutan

Mr Ugyen Tshering, Forestry Officer, Jigme Khesar Strict Nature Reserve, Bhutan, stressed the importance of the workshop to serve as a platform to share experiences. Despite the success of the transboundary landscapes approach, he indicated that challenges remained and need to be prioritized and successfully addressed. He expressed his confidence that the workshop would develop a framework for LTESM in the Kangchenjunga Landscape.

Remarks from China

Prof. Zhao Xinquan, Director General, Chengdu Institute of Biology, Chinese Academy of Sciences, again emphasized the value and crucial outcomes that LTESM can bring not only for future generations but also for sustainable development. Therefore, he believed that the workshop would work towards fulfilling the Sustainable Development Goals. He expressed his expectations for the mutual sharing of experiences on long-term monitoring over the course of the workshop.

Remarks from GIZ

Mr Manfred Seebauer, Chief Technical Advisor, GIZ, welcomed all participants on behalf of GIZ. He noted that monitoring is a tool and should be seen as one of many components in the planning process. He emphasized the importance of working with concrete indicators, as well as attending to their quality when designing them. Lastly, he stated that reliable data sets are necessary for a functional long-term monitoring process and must be combined with knowledge about climate change.

Remarks from the Chief Guest

Chief Guest, Prof. Dr Tirth Raj Khaniya, Vice Chancellor, TU, indicated that based on the remarks from the previous speakers, many issues must be addressed in the HKH. He noted that the Himalaya are vulnerable not only from a natural resources perspective but also from the perspective of rural livelihoods. He duly appreciated ICIMOD's role in the management of natural resources at the landscape level. The transboundary landscapes program is a milestone towards addressing conservation and development issues by protecting natural resources and uplifting livelihoods of local communities. Working towards this goal, he highlighted that the workshop would play a crucial role for biodiversity conservation, climate change adaptation, and rural livelihoods. He emphasized the need to attend to areas where climate change would be most perceptible. He concluded by expressing his hope that the joint actions of academic and international organizations would bring about remarkable benefits.

Vote of thanks and closing of the session

Dr Rucha Ghate, Senior Natural Resource Management and Governance Specialist, ICIMOD, thanked the Chief Guest and Manfred Seebauer for their support. She stressed the combination of academic, governmental, and non-governmental organizations participating in the workshop, a special event for ICIMOD itself. She concluded with a general vote of thanks to all participants before closing the inaugural session.

From left to right: Prof. Zhao Xinquan, Prof. Dr Tirth Raj Khaniya, Mr Manfred Seebauer

Day 2: Tuesday, 15 November 2016

Getting Started: Introductions, Expectations, Rules and Roles

The technical sessions were started by a round of self-introductions, gathering participants' expectations of the workshop (Annex 1), and laying down rules and roles. Most expectations were related to building capacity and increasing understanding of LTESM. A few expectations were based on enhancing communication skills and finalizing the Knowledge Management and Communications Strategy for KLCDI.

Technical Session 1: Long-term Monitoring in the HKH Region – Experiences, Opportunities and Challenges

Chair: Prof. Dr Ram Prasad Chaudhary, Professor Emeritus, TU

Setting the stage: the LTESM Framework for TBLs

Dr Nakul Chettri, ICIMOD, highlighted the elements of the LTESM framework[1] and emphasized the importance of open access and cross-learning for LTESM. He noted the need for a free, open access and reliable data platform as LTESM needs to be institutionalized. Building on one of the key pathways for KLCDI, i.e., national- and regional-level LTESM, the challenging task of bringing together a multidisciplinary team for long-term monitoring is necessary. Based on experience and expertise, he emphasized the consideration of three drivers of change during LTESM: demographic change, change in land use, and climate change.

Dr Rucha Ghate, ICIMOD, added that perceptions of nature generally do not include humans, as we equate 'nature' with 'ecosystems'. Humans, however, have an increasing impact on ecosystems around the world, so the integration of social aspects is highly necessary. She highlighted the significance of LTESM in understanding trends and intensity of changes which can then be used to bring about change in policy.

Ensuing discussions were on the time scale and methodologies for LTESM. Dr Chettri indicated that the KLCDI Conservation and Development Strategy (CDS) was prepared for a period of 20 years with a five-year operational plan, thus a similar time frame could be considered for LTESM. Methodologies for LTESM must be holistic and multidisciplinary with relevant indicators considered collectively by partner institutions.

Keynote presentation: Nepal's experience in long term monitoring along an altitudinal gradient – Linking forest ecosystems with community socioeconomic dynamics

Prof. Dr Santosh Rayamajhi, IoF, introduced his institution and the Community-based Forest Management in the Himalaya (ComForM) project, using the latter as the basis to discuss long-term monitoring. He noted that the objective of long-term monitoring is to enhance social and natural scientific knowledge for improved decision making and management planning. He then described the ComForM research framework: monitoring forests using a common research protocol in three physiographic zones with 340 permanent sample plots in Chitwan, Kaski, Gorkha, and Mustang Districts. Forest monitoring has been done in 2005, 2010, and 2013. Results documented incremental changes in forest stock (e.g., through extraction) which had implications at the household level. Dr Rayamajhi concluded by pointing out the need for collaboration, coordination, and networking in order to achieve long-term monitoring.

Next, Prof. Dr Bir Bahadur Khanal Chhetri highlighted the socioeconomic outcome of ComForM. Many forest-dependent people are very poor, and recent debates have centred on the role of forests in providing a safety net, as well as a pathway out of poverty. Thus, different aspects must be considered to determine the role of the forests and to balance out different trade-offs. Annual household surveys were conducted in four ComForM sites using

[1] Chettri et al. (2015). Long-term environmental and socio-ecological monitoring in transboundary landscapes: An interdisciplinary implementation framework. ICIMOD Working Paper 2015/2. Kathmandu: ICIMOD.

standardized methodology. Results indicated that a larger proportion of income is generated from environmental services among poor households than among richer households. Also, the share of income from environmental services decreased from 2006 to 2012.

In the discussion round, Dr Rayamajhi addressed questions related to time and resources required for monitoring. He indicated that the size of the forest in Kaski District was 79 ha, and its monitoring involved undergraduate, graduate, and PhD students, with an additional two to three staff working in the field for 30 to 40 days. Discussions also revolved around the size of the permanent plots which were 20m*25m for ComForM, as opposed to the global standard of 1 ha. Dr Rayamajhi responded that the national forestry guidelines were followed in forest monitoring for the project. The availability of project data was discussed; although the data is not publicly available, Dr Khanal indicated that data sharing could be possible based on institutional requests. The ComForM project was funded by the Danish Government.

A list of references related to the ComForM project are attached as Annex 2.

Grassland management on Qinghai-Tibetan Plateau: Based on long term monitoring and control experiments

Prof. Zhao Xinquan, CIB, gave an overview of rangeland monitoring in China. He briefly presented the techniques used, as well as their area of application. These techniques are now used at a large scale for long-term research, the results of which will subsequently feed into recommendations for policy makers. In the following round of questions, Prof Zhao discussed how the research findings contribute to policy as they work through big projects whose results are submitted directly to the Chinese government. He also pointed out that their current research focuses on ecosystems research rather than on socio-economic aspects.

Monitoring responses of alpine vegetation to climate change using the GLORIA methodology in the Nepal Himalaya

Dr Suresh Ghimire, Central Department of Botany/TU, introduced the alpine environment as having high biodiversity on one hand, but being highly vulnerable to climate change on the other. Using the GLORIA methodology, Dr Ghimire's research involves monitoring changes in alpine plant species in relation to temperature. Five permanent monitoring sites have been established in Nepal. From the GLORIA sites, 450 plant species have been documented, among which 49% are Himalayan endemics. Species richness decreased with increasing

View of the Annapurna mountain range from Hemja, Kaski District, Nepal

elevation and increased towards the west along an east-west gradient. Challenges included finding the 'perfect' summits to lay permanent plots, steep terrain, and high labour intensity.

Discussions focused on funding mechanism and monitoring results. Dr Ghimire responded that currently his research was funded by National Geographic in eastern Nepal and KSLCDI in western Nepal, and that the absence of a species during repeat monitoring was interpreted as being 'not found', as opposed to being 'lost' due to climate change.

A summary of the presentation can be found in Annex 3.

Long-term monitoring of peatlands on the Zoige Plateau of China

Dr Zhu Dan, CIB, introduced the high-elevation Zoige Plateau at average elevations between 3,400–4,000m. Approximately 15% of the 30,000 sq. km. area is peatlands. These peatlands face severe pressure from climate change and subsequent drying, overgrazing, peat mining, and draining through human activities. The research monitoring topics were related to peatland development through a historical context, contemporary carbon cycle, and future fate of the peatland under climate and management scenarios. Results indicate that peat accumulation rates range from 5 to 48 g $m^{-2}yr^{-1}$, and that the peatlands store an estimated 0.477 Pg (1 Pg = 10^{15} g) of carbon.

In the following round of questions, it was discussed if China could possibly be included in the Kanchenjunga Landscape. Participants considered this an important issue as water dynamics in Kanchenjunga Landscape also involves Chinese territory.

A summary of the presentation can be found in Annex 4.

Glacier monitoring in the Himalayas

Dr Anna Sinisalo, ICIMOD, presented on glacier monitoring in the Himalaya. She introduced the key question as what is currently happening to glaciers in a changing climate, with reference to the relationship between local/regional climate and glacier response, and the consequences of glacier changes to communities downstream for water resource management. Glacier monitoring can be achieved through *in situ* measurements, modelling, and remote sensing, with capacity development and knowledge management being key aspects of the process. Currently, ICIMOD is conducting field-based glacier monitoring in Nepal (Everest region, Langtang Valley, and Dhaulagiri region) and Bhutan (Thana Glacier). To understand glacier behaviour in detail, long-term monitoring is needed with at least five years of data to draw any conclusion. Important criteria for a glacier monitoring program include being sustainable, having a long-term perspective, and using consistent methodology. In response to a query from one of the participants, Dr Sinisalo clarified that GPR is used to measure ice thickness.

A summary of the presentation can be found in Annex 5.

Community based red panda monitoring in Eastern Nepal

Damber Bista, Red Panda Network (RPN), presented on the monitoring aspect of their integrated red panda conservation program in the Panchthar-Ilam-Taplejung (PIT) corridor of eastern Nepal. The red panda is an endangered species found in five countries in Asia. In the PIT corridor, RPN is working with citizen scientists, known as Forest Guardians, in their community-based monitoring program. Based on consultations with community forest user groups (CFUGs), the Forest Guardians and RPN identify potential red panda habitats and then demarcate the monitoring sites where they conduct field surveys four times a year in January, April, July, and October. Monitoring variables include presence sign, habitat quality, and disturbances/threats. Recently, a mobile application was introduced to Forest Guardians for field-based monitoring and data submission. Challenges in community-based red panda monitoring are poor data quality, delayed reporting, and the high levels of effort required to achieve successful monitoring.

In the discussions round, questions were asked on the incentives for communities to be involved in species monitoring and the commercial value of red panda that is resulting in its illegal trade. To the former query, Mr Bista mentioned that the monitoring program is part of a larger integrated conservation program which also includes ecotourism that provides direct benefits to communities. To the second question, he was unable to provide a clear value, but he iterated that poaching has increased, with 72 cases reported from the last four years.

A summary of the presentation can be found in Annex 6.

Closing of the session

Prof. Chaudhary closed the session by briefly summarizing all the presentations made during the session and highlighting the importance of long-term monitoring in the HKH.

Technical Session 2: Long Term Monitoring in Transboundary Landscapes — Progress, Challenges and Opportunities

Session Chair: Prof. Zhao Xinquan, Director General, CIB, CAS

Long-term monitoring in TBLs: progress, challenges, and opportunities

Presentations of monitoring programs conducted in the Kailash Sacred Landscape were made in poster formats by Chandra Kanta Subedi (RECAST), Dr Gopi G.V. (WII), and Dr Sanjeev Bhuchar (ICIMOD).

Forest LTESM in Kailash Sacred Landscape, Nepal

Chandra Kanta Subedi, RECAST, presented monitoring work involving forest LTESM in KSL-Nepal. He presented two methodologies for addressing two research questions: a 1-hectare permanent plot monitoring methodology to document changes in forest structure in response to climate change, and a methodology similar to ComForM to observe how the forest structure is responding to social dynamics in the study sites. For the second methodology, a socioeconomic survey was also conducted using household questionnaires, focus group discussions, and key informant interviews. Forest LTESM is challenged by difficult terrain, plot sustainability in the long term, and lack of an established data sharing mechanism.

A summary of the presentation can be found in Annex 7.

Establishment of long term environmental and socio-ecological monitoring sites for wildlife monitoring in Kailash Sacred Landscape, India

Dr Gopi G.V., Wildlife Institute of India (WII), reported that the Bans-Maitoli area of Gokerneshwergad Watershed in Pithoragarh was selected as the LTESM site for KSL-India. Thirteen permanent plots have been established here to monitor vegetation, insects, birds, mammals, human wildlife interactions, and invasive species. The Bans-Maitoli area hosts diverse habitats that support high species richness. Fourteen mammals have been confirmed in the study area, with the rhesus macaque showing the highest encounter rate, followed by common langur, and wild pig. Dr Gopi noted that wildlife population can be estimated by mark-and-recapture method.

A summary of the presentation can be found in Annex 8.

Methodology and approach for spring revival

Dr Sanjeev Bhuchar, ICIMOD, gave a presentation on the monitoring of springs as well as the approach for their revival. He presented the eight-step methodology for springs monitoring and revival:

- comprehensive mapping of springs and springsheds
- setting up a data monitoring system
- understanding social and governance aspects

Poster presentation of methodology and approach for springs revival

- hydrogeological monitoring
- creating a conceptual hydrogeological layout of the springshed
- classification of spring types
- identifying mountain aquifer and recharge area
- developing springshed management protocols
- measuring hydrological and other impacts of spring revival activities

Challenges in the process were related to data sharing and ensuring quality data generation from the field. Results from springs monitoring work conducted in three districts of Nepal were also shared. In response to a query, Dr Bhuchar indicated that land use change may be one of the major reasons for drying up of springs.

A summary of the presentation can be found in Annex 9.

Group work on interpreting monitoring data

An interactive group session was organized to engage participants in interpreting data through environmental and socio-ecological lenses. Participants were separated into five groups and provided monitoring data in various formats: photographs, aerial photographs, and graphs. Each of the four groups were tasked to interpret the respective cases assigned to them in terms of socio-ecological implications and present their monitoring 'story'. The 'data' and group interpretations are summarized below.

Group 1

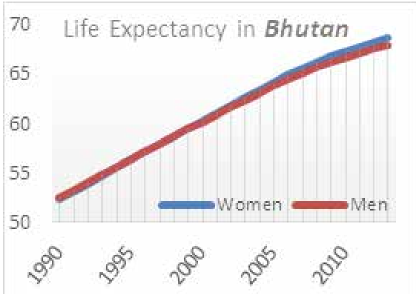
The group formulated their research question on the drivers of forest cover change between the period of 2006 to 2014. They emphasized the need to conduct research on this issue and to then prepare an integrated land use plan for development and conservation.

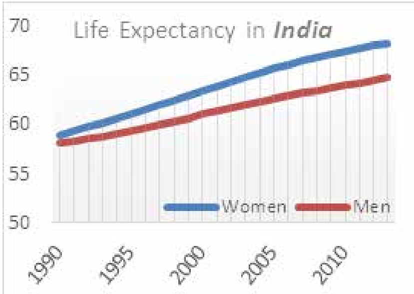
Group 2

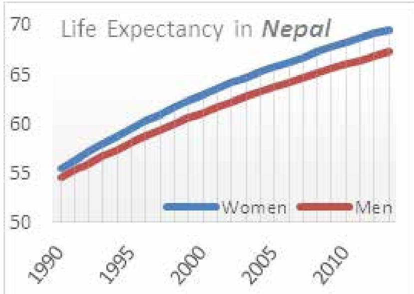
The group proposed two research questions: i) what are the driving factors and consequences of the retreating glacier and the vanishing river, and ii) what are the socio-ecological and socioeconomic impacts downstream.

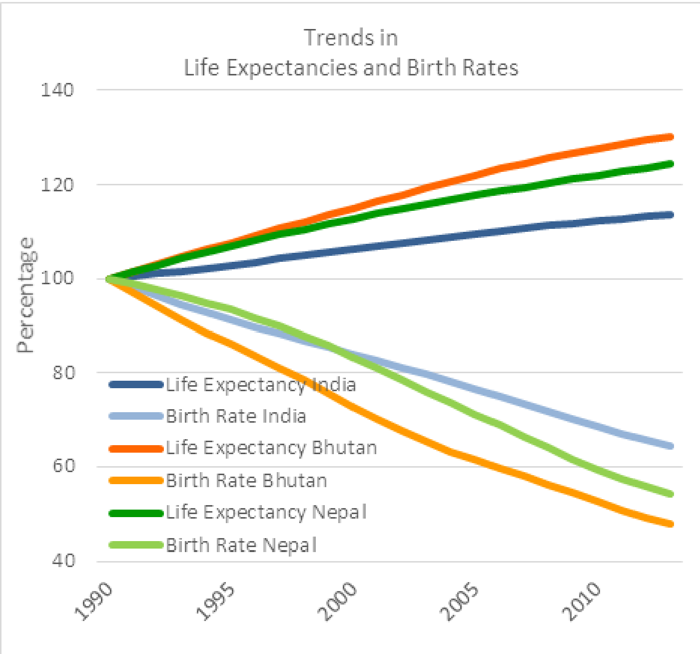
Some drivers of this change were identified as encroachment and clearing, grazing, settlements, and demography. The group hypothesized that the vanishing river is due to decreased water infiltration rates. The group prioritized policies for climate change mitigation and adaptation, along with policies for resettlement.

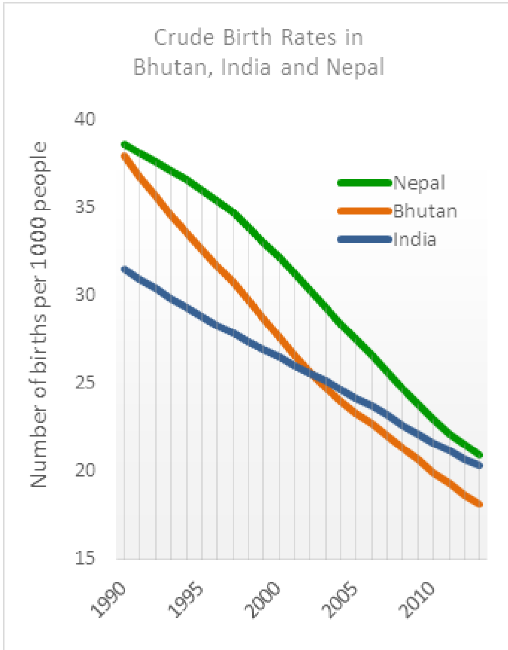
Group 3











The group noted that the population was aging with more old people in the landscape. This would have negative consequences on the economy, especially with labour shortages in the agriculture sector. Social aspects would have to be monitored on a country level as children take the responsibility of caring for their parents in the long term.

Group 4

The research question was framed as how did the forest area change within six years (2005–11) in reference to land use and forest cover, and how did this change affect water availability. The dynamics between communities and government forest needs understanding. It was noted that the river was drier in the past, hence the difference in water availability to communities would be worth analysing.

Group 5

The group framed their research question around how land use and land cover change over four decades have impacted biodiversity. Monitoring would be conducted on the forest ecosystem, agro-ecosystem, demographic changes, wildlife, ecosystem services and functions, environmental parameters, invasive species, gender and governance, socio-economy, and policy.

This group session was then followed by two more presentations and closing of the session.

Presentation of group work on interpreting monitoring data

Monitoring forest resources of Nepal using permanent sample plots

Shiva Khanal, Department of Forest Research and Survey, MoFSC, presented on the national Forest Resource Assessment (FRA) program, a joint effort between the Governments of Nepal and Finland conducted between 2010 and 2014. While the past assessment had a major focus on timber, the current assessment included other parameters such as soil, non-timber forest products, disturbance, and wildlife. Moreover, each plot was treated as a permanent sample plot (PSP) for periodic monitoring. In total, 2,544 PSPs were established across the country. Challenges in the process include difficult terrain, especially in the mid-hills and mountains, weather conditions, and financial considerations. Data from PSPs will provide important insight into forest stock, soil carbon, and biodiversity indicators, while information from repeated measurements will be helpful for Monitoring, Reporting, and Verification (MRV) for REDD+ and to understand how Nepal's forests are changing over time.

In the discussion after his presentation, Mr Khanal explained that the forest measurement was done over a five-year period. He also clarified that the data generated from this assessment is at a national level and would not be possible to develop local-level forest operational plans.

A summary of the presentation can be found in Annex 10.

Long-term socio-ecological monitoring of rangelands in China: Case study in the Qilian Mountains

Prof. Ruijun Long, ICIMOD, presented a study on an alpine rangeland ecosystem in the Qilian Mountains in the north-east portion of the Qinghai-Tibetan Plateau. The rangeland provides three important services — production services, livelihood services, and ecological services — with a high emphasis on production services. He pointed out the need to balance these services by especially considering the human factor which is interlinked with ecology on many different levels. Prof Long also presented the results of a 30-year socio-ecological study he conducted in this site providing long-term data on livestock-holding patterns, stocking rate, rangeland conditions, and socioeconomy of herders in the study area. Prof Long concluded with some insights on the what, where, how, and who of LTESM in the HKH. He emphasized the need for transboundary cooperation mechanisms and that long-term funding is required to achieve long-term monitoring.

In the discussion, Prof. Long indicated that the population in the study site was decreasing as a result of outmigration especially for education, thus this was a priority in the area. The area also imposes a seasonal four-month ban on grazing in the area to support ecological functions.

A summary of the presentation can be found in Annex 11.

Closing of the session/briefing for next day's field trip

The Session Chair, Prof. Zhao Xinquan, closed the session with appreciation to all the presenters.

This was followed by a briefing on the following day's field trip to Tibrekot Community Forest in Hemja and visit to the Institute of Forestry.

Day 3: Wednesday, 16 November 2016

Field Trip

A field visit was conducted to Tibrekot Community Forest, in Hemja VDC, approximately 10 km from Pokhara. This forest is one of the sites where IoF is implementing the ConForM project. The 79 ha Tibrekot forest was handed over to the local forest user group as a community forest in 2002. There are currently 265 households in the Tibrekot CFUG, and its executive committee consists of 11 members, of which three are female and eight are male. Most of the households are Chhetris (59%), while Dalit and indigenous households collectively comprise only 2% of the total households. Livelihood strategies include agriculture, livestock, and remittances from family members working abroad. The community forest is a deciduous montane forest situated at an altitude of 900–1000m. Main tree species are *Castanopsis indica* and *Schima wallichii*. Resources extracted from the forest include timber, green firewood, dry firewood, grasses, leaf litter, broom grasses, and leaf litter.

Workshop participants interacted with members of the CFUG executive committee, headed by Mr Bal Bahadur Kunwar, Chairperson. In response to queries, Mr Kunwar indicated that raising awareness among CFUG members on the value of forest ecosystem services was important for conserving their forest. Challenges to forest management were the heterogeneity of socioeconomic groups within their CFUG and thus the varying requirements of forest resources. Different kinds of wildlife could be found in the forest, but mostly monkeys and leopards. The IoF ComForM team, led by Dr Santosh Rayamajhi, then demonstrated the field methods used for forest measurement, including plot establishment and use of equipment, among others.

Participants then visited the Institute of Forestry's campus at Hariyokharka. Prof. Dr Krishna Raj Tiwari, Dean, IoF, made a brief presentation on the educational program at IoF. This was followed by a tour of the campus and its facilities.

Briefing by members of Tibrekot Community Forest User Group, Hemja, Nepal

Technical Session 3: The Status of Monitoring in the Kanchenjunga Landscape

An important step in long-term environmental and socio-ecological monitoring is understanding monitoring programs that are already being conducted in the landscape and the data available from such programs. Using the LTESM monitoring framework proposed by Chettri et al. (2015), group work with the three KL member countries — Bhutan, India, and Nepal — was done to take stock of monitoring data. This was followed by presentations from each country (see Annex 12 for details).

In KL-Bhutan, data relevant to many monitoring parameters and indicators is available at district and national levels. Data sources include the National Environment Commission (NEC), National Biodiversity Centre (NBC), Forest Resources Management Division (FRMD), Forest Information Management Systems (FIMS), and National Statistics Bureau (NBS). In KL-India, data is generally more available for the state of Sikkim, although much of the socioeconomic and ecological monitoring is limited to select research sites and case studies. Data is available from government, non-government, and research institutions. Similarly, in KL-Nepal, monitoring data is generated from research projects conducted at select sites. In the landscape, long-term monitoring is generally limited to weather and population census surveys, but the data is not always readily available.

Day 4: Thursday, 17 November 2016

Technical Session 4: Socio-Ecological Systems and Gender and Governance

Analyzing social systems and understanding socio-ecology through gender and governance perspectives using participatory approach

Long term environmental and socio-ecological monitoring

Dr Rucha Ghate, ICIMOD, presented on LTESM by introducing a basic framework as well as common data collection methods and explained the necessity of common standards. Furthermore, strengths and weaknesses of different approaches were discussed. Dr Ghate concluded by showing different examples of publications that make use of multidisciplinary research.

This was followed by a puzzle game to illustrate the concept of gender and inclusion. Facilitated by Dr Kamala Gurung and Dr Rucha Ghate, participants were divided into four groups, each led by a woman participant who had secretly hidden one of the pieces of the puzzle. Initially, none of the women were asked about the missing piece, and it took some time before each group 'unlocked' the mystery and were able to complete the puzzle. Participants considered the game to be very informative and representative of current reality.

Monitoring gender and socio-economy in LTESM: Indicators and measurement

Dr Kamala Gurung, ICIMOD, presented on how to make gender inclusive in the existing LTESM framework. Meaningful participation and inclusive decision making were two important principles covered in the presentation and were validated with indicators and specific parameters for measurement. She emphasized that it was important to have not just a structure to measure in but also the right parameters. She also highlighted the role of gender and households when conducting surveys to gather data. In the case presented, the same households were used since the 1980s to ensure reliable results.

Participatory approaches in LTESM

Kamal Aryal, ICIMOD, presented on the necessity and methodology for using a participatory approach in LTESM. He highlighted several participatory rural appraisal (PRA) tools through which local communities could be actively included in the LTESM process. Sharing of knowledge between citizen scientists and other researchers/scientists

Making gender inclusive in the LTESM framework

could be extremely powerful in filling in data gaps and developing appropriate policies for natural-resource management. However, the successful inclusion of community members in the process depends on the willingness of researchers to be inclusive and participatory.

Governance and institutions in ecosystem management

At the start of her presentation, Dr Rucha Ghate practically illustrated that it takes a long time for any change to occur by challenging right-handed participants to sign their name with their left hand. She then explained the topics of governance and institutions, and that the two must work in an integrated way in order to achieve success. This message was reinforced through findings of a study on common pool resources in India.

Technical Session 5: Developing a Road Map for LTESM in Transboundary Landscapes

Indicators for LTESM in transboundary landscapes

With the LTESM Framework as a guiding document, participants collectively identified indicators for LTESM in four major ecosystems: rivers and wetlands (including springs and glacial lakes), forests, grasslands, and agro-ecosystems (Tables 1a–1d). Four parameters were considered while developing these indicators: purely ecological indicators, livelihoods related indictors with reference to socioeconomics and gender, climate change related indictors, and indicators related to governance and policy. Participants of each group are presented in Annex 13.

Table 1a: **LTESM indicators for rivers and wetlands**

Parameter	What to measure? Indicators	How? Method — Timeline	Who will measure?
Ecological	Quantity: discharge/volume	Standard hydrological and meteorological methods (for rivers and wetlands) 8-step method for springs	Research organizations Local communities
	Water quality	Standard methodologies	Research organizations Local communities
	Indicator species: flora and fauna (biodiversity)	Indicator species — distribution and abundance	
	Habitat characteristics	LULC	
Livelihoods (socio-economic and gender)	Access to safe water for drinking, irrigation, cultural	HH survey FGD Key informant interviews	
	Resource quantification (availability and use)	HH survey Secondary data	
	Economical gains	HH survey Market survey	
	*Market**		
Climate change	Carbon sequestration	Standard methodologies	
	Quantification of discharge and volume	Exit flow assessment Direct field measurements 8-step method for springs	
Policy and governance	Institutions – local to landscape	Review	
	State of policies	Review	
	Change in policy	Review	

* Indicator added during group discussion

Table 1b: LTESM indicators for forests

Parameter	What to measure? Indicators	How? Method — Timeline		Who will measure?
Ecological	Land use and land cover change	Remote sensing (satellite images) Every 5 years		
	Biomass	Forest inventory in permanent sampling plots Every 5 years		
	Biodiversity: flora and fauna	Keystone and flagship species assessment (along with forest inventory) Camera traps Transect walks Surveys		
	*Connectivity of forest patches**			
	*Competition for prey species**			
	*Vertical spread of species**			
	*Community composition of indicator species**			
	*Species regeneration, including of IAS**			
Livelihoods (socio-economic and gender)	Demographic changes, including migration	Secondary data (census)	Every 3–5 years	
	Economic status of communities	HH survey FGD		
	People's perceptions on forest dependency	HH survey		
	*Forest ecosystem services**			
Climate change	Plant phenology	Permanent plots, field observations, time series analysis Annual basis		
	Water availability	HH survey, field survey Every 3–5 years		
Policy and governance	Effectiveness of institutions	HH survey, FGD, field observations	Every 3–5 years	
	State of policies at national and subnational levels	Policy review		
	Policy influence between communities and government	HH surveys, FGD		

* Indicator added during group discussion

Table 1c: LTESM indicators for grasslands

Parameter	What to measure? Indicators	How? Method — Timeline	Who will measure?
Ecological	Biodiversity: species, community, range-restricted, indicator species, *abundance*	Transects/quadrats Every 3–5 years	Government Academic institutions Local community I/NGOs Development partners
	Biomass, including area coverage and productivity		
	Soil and water: C, N		
	Fire ecology		
	*Carrying capacity/stocking rate**	Control plots — enclosures	
	*Soil degradation: erosion, moisture**		
Livelihoods (socio-economic and gender)	Socio-economy with emphasis on gender: demography, household income, goods, sanitation, type of house	HH survey FGD Key informant interviews Every 3–5 years	
	Livestock and products including NTFPs, NGPRS, tourism		

Table 1c: LTESM indicators for grasslands

Parameter	What to measure? Indicators	How? Method — Timeline	Who will measure?
Climate change	Weather patterns: temperature, precipitation	Automatic weather stations Data loggers Secondary data	Government Academic institutions Local community I/NGOs Development partners
	Changes in species composition and phenology of indicator species	Transect/quadrats Every 5 years	
Policy and governance	Equity/gender/caste disaggregated data	HH survey FGD Review of policy documents Livestock depredation records Every 3–5 years	Government NGOs Private/local institutions
	Access to resources		
	Institutions		
	Human-wildlife conflicts (esp. with snow leopards)		

* Indicator added during group discussion

Table 1d: LTESM indicators for agro-ecosystems

Parameter	What to measure? Indicators	How? Method — Timeline		Who will measure?
Ecological	Soil quality	Soil samples	Annual basis	Research and development institutions NGOs
	Water conditions	Water		
	Biomass extraction	Household survey		
	Agro-diversity/productivity	Household survey, FGD, field observations, cropping calendar		
	*Trends in livestock (particularly sedentary) populations**			
Livelihoods (socio-economic and gender)	Demographic change	HH survey, FGD, secondary data-based analysis	Annual basis	Research and development institutions NGOs
	Household income	HH survey, FGD		
	Livelihoods diversification	HH survey, FGD		
	*Changes in traditional/ indigenous knowledge and the impact on agriculture**			
	*HWC in agro-ecosystems**			
	*Adoption of agriculture/livestock related technology**			
Climate change	Climate variables	Secondary meteorological data	Annual basis	Meteorological departments
	Extreme events	Daily observations		
	*Sustainability of climate smart agricultural practices**			
	*Cropping patterns**			
	*Crop diseases (with emphasis on resistant varieties)**			
	*Crop yield**			
Policy and governance	Access to resources	Internet, FGD	Annual basis	Research and development institutions NGOs
	Equitable benefit sharing (EBS)	FGD		
	Policy impacts	Review		

* Indicator added during group discussion

Developing the LTESM roadmap for Transboundary Landscapes

Using the indicators developed for the four identified ecosystems (Tables 1a–1d), LTESM road maps were developed for three transboundary landscapes: Kangchenjunga Landscape (Table 2a), HKPL (Table 3), and Hi-LIFE (Table 4). LTESM for the Kangchenjunga Landscape was further discussed in detail among the three member countries: Bhutan (Table 2b), India (Table 2c), and Nepal (Table 2d).

Table 2a: **LTESM road map for Kangchenjunga Landscape**

Activity	KL-Bhutan	KL-India	KL-Nepal
Determine locations of LTESM sites	Meetings and consultations required	Barsey – Singalila Dzongu Bandapani	(Sites indicated in Table 2d)
Responsible institutions	WCD, DoFPS	GBPNIHESD, Forest Dept (Sikkim and West Bengal), NGO partners (ATREE, TMI, MLAS, HNAF, etc.), other gov't organizations (WII, BSI, etc.)	MoFSC, RECAST, ++++
Target date	January 2017	Early 2017	Completed
Finalize methodology for LTESM	Review existing methodologies in Bhutan and adapt for LTESM	LoA signing Local government permission Project/program staff	Consultations for methodology
Responsible institutions	WCD, DoFPS (KLCDI team)	GBPNIHESD	MoFSC, RECAST, ICIMOD, Partners indicated earlier
Target date	June 2017	December 2016	July 2017
Establish LTESM plots: start field work	Start field work on LTESM	Standardization and implementation of monitoring protocols	Field work
Responsible institutions		GBPNIHESD, WII, FDs, ATREE, other organizations	RECAST, ++
Target date	August 2017	Standardization: December 2016 to February 2017 Implementation: February 2017 onwards (forest ecosystem)	September 2017

Table 2b: **Preliminary description of LTESM in KL-Bhutan**

Ecosystem	Key indicators	Methodology		
		How?	Where?	Who?
Freshwater	√ Physico-chemical properties	Standard methodology	Jigme Khesar Strict Nature Reserve: Nub-Tshonapata	DoFPS NEC UWICER NRCRLF
	√ Macro-invertebrates			
	√ Plants			
	√ RET species	Survey		
	√ Resource availability and use			
	√ Spring water discharge	Refer to spring shed management guidelines — national method		
Forests	√ Biodiversity	Survey, assessment, secondary data review	TBD	DoFPS NBC UWICER
	√ Land use and cover	Geospatial technologies, ground truthing		
	√ Ecosystem services	Survey, assessment, analysis		
	√ Plant phenology	Survey, field observations		
Grasslands	√ Productivity		TBD	DoFPS DoL MoAF
	√ Diversity	Assessment, survey		
	√ Livestock products	HH survey, secondary data review		
Agro-ecosystems	√ Agrobiodiversity		TBD	NSB
	√ Livelihoods diversification			

Table 2c: **Preliminary description of LTESM in KL-India**

Ecosystem	Key indicators	Methodology		
		How?	Where?	Who?
Freshwater	√ Physicochemical properties	Water quality monitoring	Pilot sites, with emphasis on site 3	GBPNIHESD WII ICIMOD TMI ATREE
	√ Macro-invertebrates			
	√ Plants			
	√ RET species	Distribution and abundance estimation		
	√ Resource availability and use	HH survey, FGD, resource mapping		
	√ Spring water discharge	Flow assessment		
Forests	√ Biodiversity	Biodiversity assessment methods (identifying indicative flagship species and status assessment)	Pilot sites	GBPNIHESD WII ICIMOD TMI ATREE
	√ Land use and cover	Satellite data		
	√ Ecosystem services	HH survey, pollination assessment		
	√ Plant phenology	Monitoring phenophase (monitoring calendar)		
Grasslands	√ Productivity	Biomass estimation	Site 2	GBPNIHESD WII ICIMOD TMI ATREE
	√ Diversity	Indexes (ecological) methods		
	√ Livestock products (not applicable in KL-India)			
Agro-ecosystems	√ Agrobiodiversity	HH survey, FGD, crop registers	All pilot sites	GBPNIHESD WII ICIMOD TMI ATREE
	√ Livelihoods diversification			

Table 2d: **Preliminary description of LTESM in KL-Nepal**

Ecosystem	Key indicators	Methodology		
		How?	Where?	Who?
Freshwater	√ Physico-chemical properties	Standard methodology	Mai Pokhari (Ilam) Sudu Pokhari (Taplejung)	MoFSC DFO DHM RECAST CDB IoF DDC
	√ Macro-invertebrates	Quadrat sampling		
	√ Plants	Quadrat sampling		
	√ RET species	Transect + Quadrat		
	√ Resource availability and use	Resource assessment, HH survey		
	√ Water level*			
Forests	√ Biodiversity	PSP, field survey, camera traps	70m Jalthal (Jhapa) 1000–1500m TBD 1500m Sidin (Panchthar) and Bahundangi (Jhapa) 2500m Chyangthapu (Panchthar -Singalila Range) 3900m Ghunsa valley (Taplejung)	MoFSC DHM RECAST CDB IoF DFO DDC
	√ Land use cover	GIS		
	√ Plant phenology	Field survey, GIS, PSP, herbarium analysis		
	√ Ecosystem services	HH survey, field survey, FGD		
	√ Livelihoods diversification (argeli and lokta)	Resource assessment, technology, FGD		
	√ Human-wildlife conflict	FGD, HH survey, field survey		
Grasslands	√ Productivity	Transect, PSP Household survey Soil sample analysis	Ghunsa valley (Taplejung)	MoFSC KCAMC WWF RECAST CDB
	√ Diversity			
	√ Livestock products			
Agro-ecosystems	√ Agro-biodiversity (crop)	Diversity fair Genetic analysis	Chilindin (Panchthar)	MoFSC MoA DADO NARC DLSO
	√ HH income (akabare vc)	HH survey		

* Indicator added during group discussion

Table 3: **LTESM road map for HKPL (cold desert)**

Activity	Description	Responsible institution	Target date
Determine location for LTESM sites	Wakhan Valley	MAIL, NEPA, WCS	December 2018
	Broghil Village	KP FWED	
	Qurumbar Village	GB FWED	
	Khunjerab Village		
	Taxkargan	XIEG, Taxkargan Forest Dept	
	Zorkul National Park	ZNP depH, UCA	
Finalize methodology for LTESM	Finalize framework for cold desert rangeland monitoring Indicators for measurement: A) Production B) Species composition C) Stocking rate/carrying capacity D) Land use land cover change	MAIL, NEPA, WCS KP FWED GB FWED XIEG, Taxkargan Forest Dept ZNP depH, UCA	December 2017
	Framework for wetland monitoring in Qurumbar and Zorkul		Start January 2019
	Framework for agroecosystem/agro pastoral monitoring		Start January 2019
Establish LTESM plots: start field work	Rangeland ecosystem: plots in four countries	MAIL, NEPA, WCS KP FWED GB FWED XIEG, Taxkargan Forest Dept ZNP depH, UCA	Started May 2016
	Wetland ecosystem		January 2019
	Agro pastoral systems		January 2019

Table 4: **LTESM road map for Hi-LIFE**

Activity	Description	Responsible institution	Target date
Determine ecosystems for LTESM	Forests – 2 plots each	India: GBPNIHESD and partners China: KIB and partners Myanmar: FD and partners	2017: baseline study
	Rivers and wetlands		
	Agro-ecosystems		
	Grasslands (not applicable)		
Finalize methodology for LTESM	Indicators for forest ecosystems: A.1 Biodiversity — flora and fauna A.2 Ecosystem goods and services: water, climate change, NTFPs, etc. B. Land use and land cover change — using satellite data in 5-year intervals C. Livelihoods (income only): i) ecotourism (economic returns), ii) value chain (forest based) D. Policies: state and influence E. Effectiveness of local institutions		2017–18
	Indicators for agro-ecosystems: A. Traditional land use B. Agro-biodiversity C. Socioeconomy D. Output and yield		
Establish LTESM plots: start field work	Establish monitoring plots		2018

A total of at least 12 permanent monitoring plots are envisaged for LTESM in the Kangchenjunga Landscape, i.e., at least one monitoring plot in each of the four ecosystems in the three KL countries. Therefore, there is a need for an overall design/strategy for LTESM in the landscape. One of the pressing questions was how to select sites for placing the permanent monitoring plots. For example, while locating the 1-ha permanent monitoring plots for forest ecosystems, should the plot be located at an altitudinal gradient within the three countries, or should the plot be placed in similar forest types in the three countries for comparison? Participants also indicated the need for a standardized methodology for monitoring in the KL member countries, especially for lakes/water monitoring. It was noted that a monitoring protocol has been developed for rangelands by HKPL, and this could also be modified for use in the other transboundary landscapes.

In agro-ecosystems, indicators should focus more on productivity and yield, rather than biodiversity. Also, different agricultural practices and systems, such as shifting cultivation and agro-forestry systems, must also be taken into consideration for LTESM.

Next steps

Dr Nakul Chettri stated that good progress was achieved with the productive outcome of the group work. This would be taken up further in 2017 and finalized. The final goal would be to develop an LTESM manual in 2018 which could be used in other transboundary landscapes.

Knowledge Management and Communication Strategy

In an add-on session before the workshop started and at the end of the workshop, the Kangchenjunga Landscape partners from Bhutan, India, and Nepal finalised and commonly agreed on the six-page Knowledge Management and Communication Strategy KLCDI 2016–18 (KM&C Strategy KLCDI 2016–18). This strategy, in line with the Regional KM&C Strategy developed under the Kailash Sacred Landscape Development and Conservation Initiative, is a working document for effective and structured planning and monitoring of communication priorities through the year 2018.

To achieve effective communication for cooperation and coordination between all partners, an in-depth analysis of the needs for communication had been conducted during the second and third quarters of 2016 with all main partners and stakeholders of KLCDI. Based on this needs assessment, Ms Heike Junger-Sharma, GIZ consultant, had drafted a two-year KM&C Strategy for KLCDI (from 2016 to 2018).

Team building among workshop participants

The goals of the KM&C Strategy for KLCDI 2016–18 are:

Goal 1. Support and further the effectiveness of the activities identified in the program implementation schedule

Goal 2. Increase efficiency of flow of information to, from, and among all KL program partners and important stakeholders, as well as among functional committees/governance mechanisms at national and regional levels

Goal 3. Raise the public profile of the programme — nationally, regionally, and globally — with identified target audiences

Goal 4. Ensure effective lobbying and advocacy with diverse project stakeholders

The sessions on KM&C Strategy KLCDI 2016–18 were twofold:

Day 1 (2.5 hour session)

- Interactive session to understand the importance of effective and coordinated communication
- Introduction to learnings and insights from assessment
- Teamwork by country to finalize commitments for KM&C Strategy

Day 3 (1 hour session)

- Rechecking of Excel matrix by all partners
- Endorsement of six-page KM&C KLCDI Strategy 2016–18 by all partners

Day 1

Ms Heike Junger-Sharma organized a short interactive session to get acquainted, to understand the expectations from the KM&C Strategy, and to decide on the communication priorities for the next two years: communication instruments for coordination amongst partners, lobbying, or implementation level.

After the interactive session Ms Junger-Sharma gave a presentation on the process for the KM&C Strategy for KLCDI, as well as the first findings from the needs assessments with partners (questionnaire interviews).

Ms Junger-Sharma gave the first insights from the assessment:

1. The initiative to develop a KM&C Strategy was **welcomed** and **considered important** by most partners
2. All partners share high emotional attachment for KLCDI
3. Partners share similar reasons for attachment/**strong messages** on KLCDI:
   - Conservation and development in one!
   - Wellbeing of people — ecosystems — transboundary
   - Richest landscape in terms of culture and biodiversity from 60–8,000m altitude!
   - Outstandingly beautiful and rich in biodiversity — specially in its culture and ethnicity — Transboundary
   - Most challenging landscape with immense biological and cultural diversity
4. **KM&C** must be strengthened in the program in the following sequence during the next two years:
   - Partner coordination and cooperation level
   - Implementation level
   - Lobbying
5. A more effective communication can only be achieved if **additional time investment** is guaranteed by the ICIMOD KLCDI team, and **focal persons** at the partner level are identified
6. There is interest in sharing knowledge and **best practices** with other KLCDI partners **across the border**. Topics for best practices (examples):
   - Efficient use of resources at all levels and law enforcement (Bhutan)
   - Homestay experience in Sikkim (India)
   - Lepcha cultural conservation method (India)
   - Radio collaring (India)

- UNESCO heritage process (India)
- Ramsar experience (Nepal)
- KL Conservation Area managed by community (Nepal)

7. There is a strong **need for additional knowledge** by partners. Topics for additional knowledge input:
   - Transboundary mechanism experiences to solve common issues (e.g., wildlife and illegal trade)
   - Transboundary corridor issues and management
   - Value chain linkage with private sector
   - Heritage and ecotourism approaches
   - Sharing of knowledge and landscape approach at local level

8. The focus area of program activities during the next two years will be on all indicators of **Output 1:** Integrated strategies for local livelihoods are developed/further strengthened (all indicators)
9. Only selected indicators of other outputs will be worked on

After the presentation on findings from the analysis and further insights given on important messages and by-country scaling of communication priorities, the country teams finalized their priorities in teamwork and shared these with the others.

Ms Junger-Sharma analysed this information during the next day.

Day 3

After analysing the team-wise inputs from Day 1, a draft strategy was developed and re-scanned by the lead partners of each country.

After Ms Junger-Sharma gave a short presentation of the final KM&C KLCDI Strategy 2016–18 version, the strategy was endorsed by all country partners, and the lead communication persons by country were named:

- Bhutan: Ms Namgay Bidha
- India: Dr HK Badola
- Nepal: Prof. Dr Ram P Chaudhary
- ICIMOD: Dr Janita Gurung

The successful endorsement of the Strategy proved the acceptance and need for structured communication. The ICIMOD KLCDI team will monitor the strategy every six months to ensure focus on priority communication instruments to be implemented.

Thanks to ICIMOD's KMC unit, as well as KLSCDI, the KM&C KLCDI Strategy 2016–18 could be endorsed successfully. Its contribution towards the impact of the program was understood by partners and ICIMOD team alike.

Concluding session

Feedback from participants

Participants scored all sessions as good on average for both gaining insights, as well as on the methods used to conduct the sessions. Logistics, including hotel, travel arrangements, and workshop facilities, scored on the high end. Individual assessment feedback is included as Annex 15.

Session	Score	
	Insights	Methods
Inaugural session	2.2	2.4
KLCDI KM&C Strategy 2016–18	2.5	2.5
TS 1: LTESM in the HKH Region	2.5	2.5
TS 2: Sharing experiences on LTESM from TBLs	2.3	2.4

Field trip	2.3	2.2
TS 3: Status of monitoring in KLCDI	2.4	2.4
TS 4: Socio-ecological systems, Gender, Governance, Participatory approach	2.5	2.4
TS 5: Road map for LTESM in TBL	2.3	2.3
Logistics		
Hotel	2.9	
Travel logistics	2.8	
Workshop facility	2.5	
Scale: 1 = low; 2 = good; 3 = excellent		

Remarks from ICIMOD

Prof. Wu Ning was positive regarding the progress made during the workshop on improving the LTESM framework. He emphasized that fieldwork must be initiated in 2017, and latest by 2018. He concluded by stating that long-term monitoring must be a priority for transboundary landscapes and wishing for future fruition of the issues discussed during the workshop.

Remarks from China

Prof. Zhao Xinquan reminded participants that a similar meeting was held two years ago in Chengdu, China, and such meetings are a great opportunity to meet and connect with different people and continue the discussion on long-term monitoring. He concluded by highlighting the value of the socio-ecological focus in long-term monitoring, and noted that research in China is lacking the social sciences.

Remarks from Bhutan

Mr Tashi Tobgyel thanked the workshop team on behalf of the participants from Bhutan for the four days of meaningful discussions. With quite a lot of technical presentations, he especially pointed out the thematic diversity through topics such as the presentation on red panda.

Remarks from India

Dr Hemant Badola expressed thanks for the productive workshop and fruitful four days of learning and discussions. He looked forward to implementing long-term monitoring in the field. He particularly appreciated the attendance of other GB Pant scientists at the workshop.

Remarks from Nepal

Mr Shiva Khanal pointed out that ecosystems know no political boundaries, which is why transboundary cooperation and discussions are necessary for success. He thanked ICIMOD, GIZ, and IoF for organizing the workshop.

Closing remarks

Dr Bir Bahadur Khanal Chhetri, IoF, expressed his appreciation to ICIMOD and IoF for organizing the workshop. He noted that as a social scientist, he had learned much about ecology and the environment. He also pointed out that despite the importance of universities in producing knowledge, linking knowledge to practice successfully is very important for wellbeing. Creating and maintaining consistent methodologies is thus needed. He concluded by thanking all participants for coming to the beautiful city of Pokhara and attending the workshop.

Annexes

List of Annexes

Annex 1: Participants' expectations from the workshop

- Communication skills improved; Long-term monitoring framework developed
- To enhance my understanding of integrating social and ecological interface in monitoring methods and stories from other countries about success/failure
- A common and practical methodology for LTESM developed
- Mountain agriculture (pastoralism), better understanding of the same
- Expecting a strong communication strategy for KLCDI implementation and an effective methodology for LTESM
- A clear LTSEM road map for the landscapes
- To identify the research priorities, learn specific methodologies for LTM of socio-ecological changes
- Suggestions, inputs on the work done on the KSCLDI for improvement and easy implementation in the field
- Workshop will help me to learn about various sectors involved for the ecological monitoring and parameters as well as methodologies for transboundary landscapes in terms of biodiversity management
- To understand LTESM in depth, theory and practice
- A clearer roadmap / next steps as what we shall do as to LTESM?
- Learning challenges, opportunities of LTESM in implementation
- Rangeland management on Tibet plateau
- Expectations (LTESM): simple, systematic, user friendly framework / efficient and informative data generated theories using the framework/road map / challenges and solutions for implementation phase
- To understand landscape level monitoring indicators and their means of verification methodology
- Learn how long-term efforts in monitoring play role in sustainable conservation of natural resources
- LTESM framework and roadmap for TB landscapes in KHK regions
- I expect to get insight into good practices and examples of long-term environmental monitoring across the region.
- I expect I learn more in communication skills from this workshop
- To understand the clear indication of LTESM
- Learn how other people are doing and see myself where I am
- Coupling science with management and policy
- To become familiar with LTESM in transboundary landscapes
- Learn about different monitoring work being carried out; concrete work plan for long-term monitoring.
- Learn and understand (get introduced) how long-term monitoring is working
- Get to know other transboundary landscape programs
- To learn LTESM methodologies that are interdisciplinary (e.g. gender); to learn LTESM methodologies applications across the KHK countries in different ecosystems
- Knowing problems in other landscapes; sharing our experiences with each other
- Expect to strengthen/broaden my knowledge on long-term monitoring and how to realise environmental and socio-ecological aspects
- Road map for LTESM in landscapes; final communication strategy
- Learn some lobbying experiments form partners
- Integrate socioeconomic-political-cultural factors impacting ecosystems in LTESM methodology
- Enrich the knowledge about LTESM; capable to implement in KL India effectively
- To have a practical, realistic and simple strategy on LTESM
- Better learning from others working on socio-ecological monitoring in transboundary landscapes (that would be presented here and discussed)
- Better understanding of the processes, methods, indicators and data-sharing mechanism for social and environmental monitoring changes
- How to synchronise the ecological and social components of landscape for monitoring in the long-term

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Annex 3: Monitoring responses of alpine vegetation to climate change using the GLORIA methodology in the Nepal Himalaya

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Introduction

The alpine region of the Himalaya is rich in biodiversity with high endemism, and at the same time supports livelihoods of the indigenous peoples and of massive downstream populations. However, alpine environments are among the most vulnerable to environmental change. Of the Alpine regions, the Himalaya are experiencing the fastest rate of climate change, with temperatures rising quickly and glaciers and snows melting rapidly.

The Global Observation Research Initiative in Alpine Environments (GLORIA) is an initiative towards an international research network to assess climate change impacts on mountain environments. GLORIA developed a long-term observation strategy known as a 'multi-summit' approach for documenting biodiversity and habitat changes. The Central Department of Botany, Tribhuvan University (TU), Nepal, in collaboration with Missouri Botanical Garden (USA); RECAST, TU; and ICIMOD have applied the GLORIA strategy to establish permanent plots in 2009–15 for monitoring the effects of climate change on alpine plant diversity from eastern to far western Nepal.

The main aims of the study are (i) to collect baseline data for long-term monitoring of species and vegetation and detect changes of vegetation cover, species richness, composition, and species migration (at observation intervals of 7 to 10 years) and (ii) assess potential risks for biodiversity losses due to climate change by comparing current distribution patterns of species and vegetation along precipitation and elevation gradients.

Gloria Sites (Target Regions) in Nepal

- *Langtang National Park*, Central Nepal: Established in 2009 in upper Trishuli valley at 4,054–4,784 m (location: 28°04.031' to 28°06.745' N and 85°23.703' to 85°25.739'E)
- *Kangchenjunga Conservation Area*, East Nepal: Established in 2010 in upper Ghusa valley at 3,884–4,827 m (location: 27°39.948' to 27°41.082' N and 87°53.093' to 87°55.756'E)
- *Annapurna Conservation Area*, Central Nepal: Established in 2011 in upper Manang at 4,147–5,006 m (location: 28°67.418' to 28°68.767' N and 84°04.060' to 84°07.482'E)
- *Humla District*, West Nepal: Established in 2012 in Upper Chhungsa valley at 4,300–5,010m (location: 30°08.380' to 30°09.997' N and 81°42.397' to 81°43.485' E)
- *Api-Nampa Conservation Area*, West Nepal: Established in 2014-15 in Chamelia valley at 3,950–4,700m (location: 29°57.303' to 29°58.822' N and 80°55.860' to 80°57.830'E)

Method

Each observation site, known as a target region, consisted of four summits exposed to the same regional macroclimate along an altitudinal gradient from above natural tree line to the uppermost vegetation zone.

Vegetation sampling

In each summit, vegetation data were recorded at three spatial levels (Fig. 1). Detailed sampling at each level provides a baseline for detecting changes in species composition.

- *Summit area sections (SAS)*: Each summit was divided into eight SAS. All vascular plant species were recorded in each SAS yielding the total summit flora.
- *Plot (quadrat cluster)*: Four permanent plots (3m×3m) were established per summit (one in each main cardinal direction) and each plot was divided into nine quadrats (each of 1m×1m).
- *Quadrat*: Out of nine quadrats in each cluster, four corner quadrats were used for sampling cover and frequency of each species. Frequency was estimated by dividing the corner quadrats into 100 cells of 0.1 m × 0.1 m using a wooden grid frame. Presence/absence of vascular plant was reported in each grid cell.

Temperature measurements and photo documentation

In the central quadrat of each cluster, a temperature data logger was fixed to compare changes of temperature and snow regimes at hourly intervals. This was followed by careful photo documentation of plots and summit setup. Photographic records were maintained for the summit area as a whole, each summit section, each corner of cross-section line, each quadrat cluster, and each quadrat.

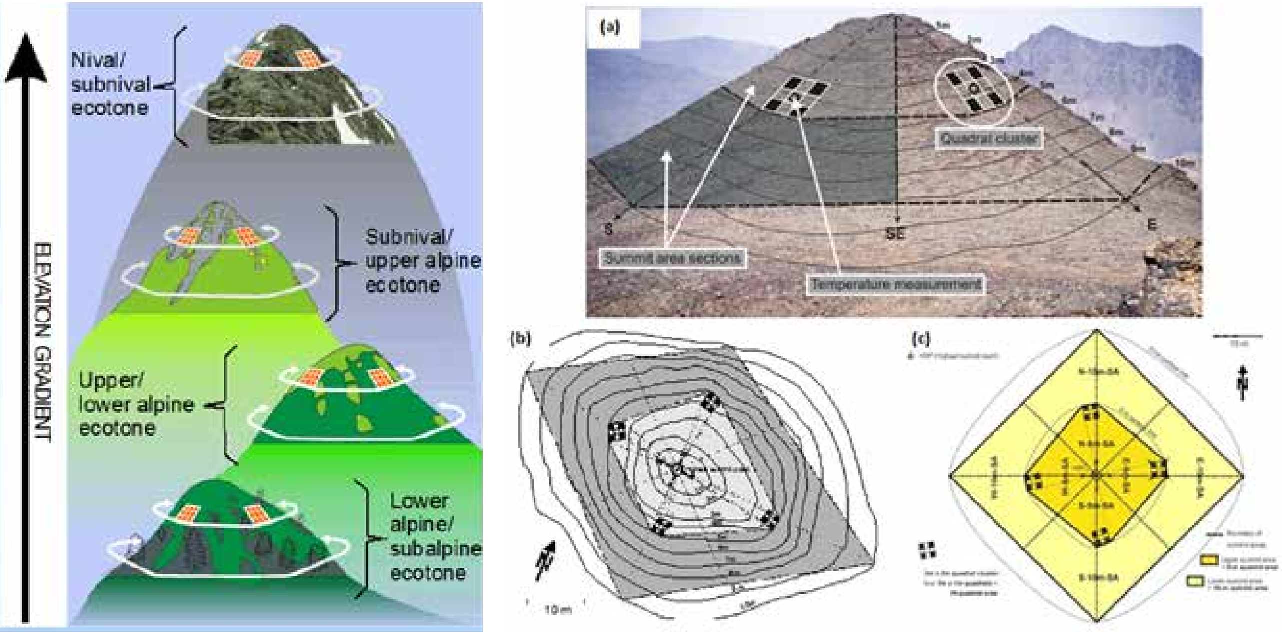

Figure 1: The multi-summit sampling design

Voucher collection and ethnobotanical study

Botanical vouchers of each taxon, from GLORIA summits and surrounding high altitude areas, were collected for botanical identity and future reference. Ethnobotanical interviews were made with local people to record uses of plants from GLORIA summits.

Data analysis

Direct and indirect gradient analyses (DCA, CCA, and NMS) were performed to interpret vegetation gradients and assess vegetation and environment relationships. The relationships between species richness and environmental variables were determined by fitting generalized linear models. Changes in species composition and diversity over time in different summit sites and aspect will be analysed though mixed- and repeated-model ANOVA.

Findings

The number of taxa sampled at all target regions totaled 450 species with 49% endemic to the Himalaya. Target regions have more taxa, more endemics, and more diversity at subalpine-lower alpine ecotone above tree line. The number of taxa and number of Himalayan endemics differed among target regions with the greatest number of taxa found in western Nepal.

CCA analysis of composition data showed that precipitation, elevation, and aspect (in that order) are important in determining species composition, whereas NMS revealed that biogeography (sites) explained a large proportion of species distributions. This indicates that the environmental and biogeographical gradients significantly impact species composition and diversity. Since climate change is expected to majorly affect both precipitation and temperature (for which elevation is a proxy), we anticipate changes in alpine vegetation as we started re-monitoring our long-term sampling sites in 2016 (at least at Langtang National Park), seven years after the initial site was established.

Majority of indicator species (>50%) distinguishing target regions and summits are Himalayan endemics, indicating their importance in differentiating alpine vegetation. Across all target regions, in average 65% of the alpine flora is reported by local people as being used, mostly for medicines, food, and animal grazing.

Challenges/Opportunities

The main challenge is finding suitable summit area for conducting GLORIA long-term monitoring due to topographic constraints. Accessibility to the site and harsh climatic conditions of alpine region are the other challenges. GLORIA establishment is labour intensive; at least 10–12 persons are needed to establish a target region and collect vegetation data in one day. However, the main opportunity of using the GLORIA method is that the protocol focuses on a standardized setup of permanent observation sites that are applicable in all major mountain systems on Earth.

Annex 4: Long-term monitoring on carbon dynamics of the Zoige Peatland

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Introduction

The Zoige Peatland, which is situated at the upper reaches of the Yellow River, is the largest alpine peatland in the world. Due to climate change and human disturbance in the last several decades, the Zoige Peatland has undergone severe degradation; however, our limited knowledge on the carbon dynamics of those peatlands is inadequate to support a sustainable management plan. Therefore, we aim to investigate 1) the initiation, development of the Zoige Peatland; 2) the contemporary carbon cycle of the peatland; and 3) the future fate of the peatland under predicted climate and management practice.

Methodology

The research 1) includes seven peatland sites across the Zoige Peatland. We sampled peat cores along a transect (1-2 km) from the edge towards the centre of each site with nine plots (1 m^2 in size, two replicates in each plot) in May 2012. Peat depth, dry bulk density, carbon content, nitrogen content and ^{14}C age of peat were analysed.

The research 2) includes one peatland site and its adjacent lake. The carbon gas exchange (CO_2 and CH_4) rates between atmosphere and peatland/lake ecosystem are being monitored. Both eddy covariance and static chamber are applied as parallel methods in peatland site, while floating chamber is applied for the lake. The plots are 4 ha and 1 m^2 for eddy covariance and chambers, respectively. The sampling frequencies are 30 minutes and 15 to 30 days for eddy covariance and chambers, respectively.

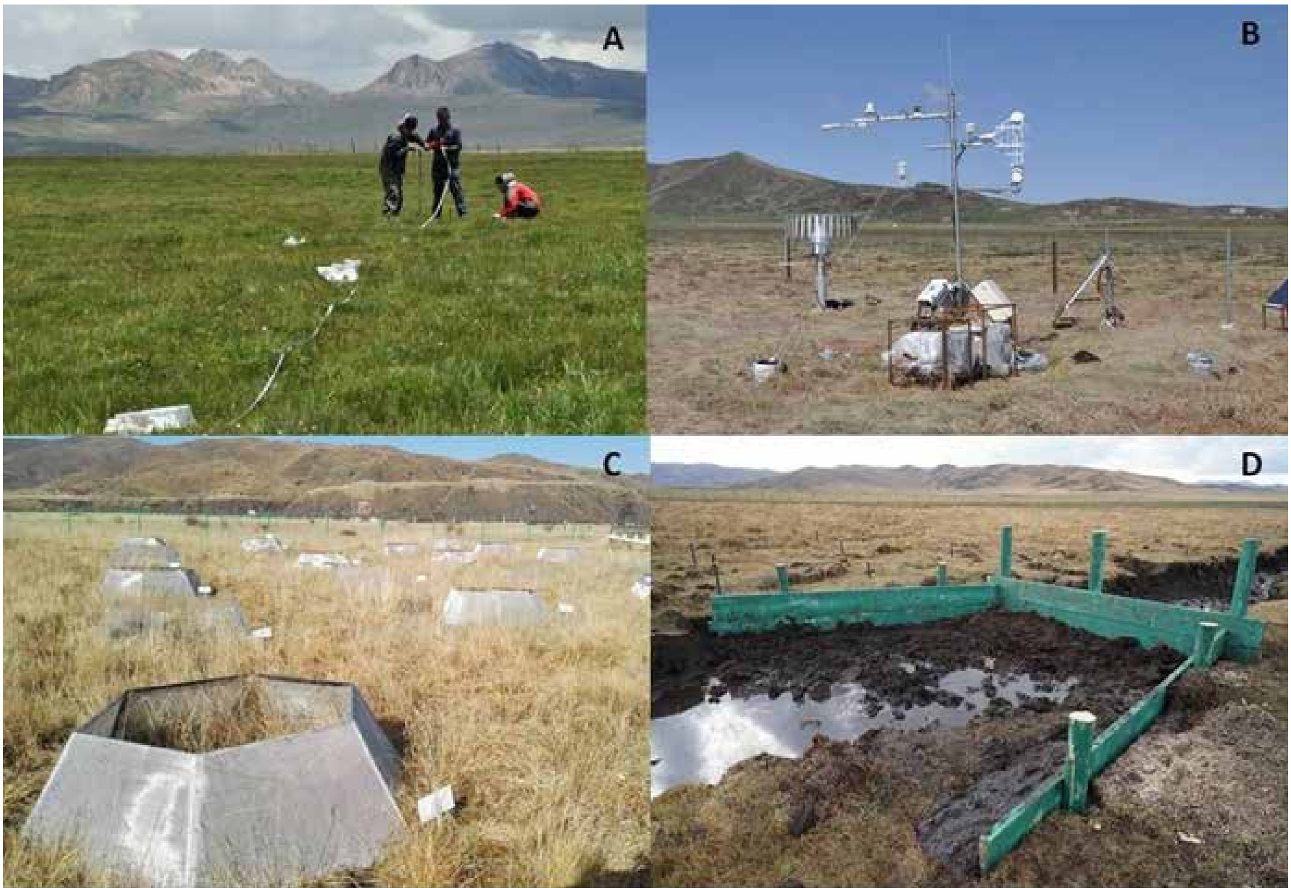

Figure 1. Field sites and their treatments: A) peat cores sampling along a transect; B) eddy covariance equipment for carbon gas and energy balance monitoring; C) open-top chambers (OTC) for warming treatment; and D) dam built on a ditch as the drain-blocking treatment

The research 3) is being conducted in a single site. The site constitutes two small adjacent peatlands, which were both drained by manmade ditches in the 1970s. We have deployed a simulation experiment of temperature and rainfall to study the response of peatland to future climate change (CC), and an experiment of drain-blocking (dam built on ditch) and drain plus (new ditch) to study the process of peatland restoration and degradation under different management strategies (MS). The carbon gas exchange rates, exportation of dissolved organic carbon, vegetation change, and such are being monitored. The plots for those parameters are 4 m^2 and 1 m^2 for the experiments of CC and MS, respectively.

Findings

In research 1) we found a) the peat depths of the sample sites ranged from 0.20m to 6.0m; b) the basal age on the plateau varied from 1,635 to 14,095 cal yr BP; c) the peat accumulation rates ranged from 0.12 to 0.85 mm yr^{-1} and the C accumulation rates from 5 to 48 g m^{-2} yr^{-1}; and d) the current peat C stock of the Zoige Peatland was estimated to be 0.477 Pg (1 Pg=10^{15} g).

In research 2) we found a) the precipitation and temperature the dominant drivers on carbon gas exchange, and b) large amount of organic carbon in peat export to aquatic environment and cause subsequent high carbon gas evasion to the atmosphere.

In CC experiment of research 3) both warming and rainfall reduction has increased the methane emissions; however, when the two treatments are combined, they have decreased the methane emissions by 58%. As the MS experiment is currently in its early stage, we do not have any findings to present.

Challenges/Opportunities

The peatland in Zoige, which is also an important regional pasture, has been distributed to local herders in 1990s. As a result, the above mentioned peatland sites are all located in private land. During one decade of implementing research projects, we recognize that the success of long-term monitoring depends on the active and positive participation of both researchers and local people. Therefore, raising awareness amongst local herders is urgently needed to ensure long-term monitoring is conducted, and the outcome of the monitoring as well. Moreover, the support from local administration would be crucial for the monitoring.

As to the peatlands in the HKH, so far their critical role as an "ecosystem interface" has been recognized by regional experts for their biodiversity maintenance, hydrological regulating, and carbon sequestration. However, their fundamental function as the regional carbon storehouse has not been studied in detail in the context of sustainable management under the changing climate, despite their occurrence under various monsoon types across the HKH. Therefore, long-term monitoring on the peatlands of the HKH with respect to their carbon dynamics could be incorporated into monitoring programmes of wider scope, so that the ecosystem services in landscape scale, the potential impact of climate change, and their consequences on the local development agendas could be better understood.

Annex 5: Glacier monitoring in the Himalaya

Anna Sinisalo with input from the Cryosphere team, ICIMOD

There are over 50,000 glaciers in the Hindu Kush Himalaya (HKH) (Bajracharya et al. 2015) and they comprise the largest glaciered area on Earth outside the polar regions. However, only a handful of these glaciers are continuously monitored; the data series are often short term (<10 years usually) or discontinuous (for example, Bolch et al. 2012). Thus, there is a huge data gap in relation to glacier monitoring and observations in the Himalaya.

Glaciers provide an excellent climatic indicator. One of the key questions of the cryosphere science and the **key question of glacier monitoring** is, What is happening to the glaciers in the changing climate in the Himalayas? This question leads directly to the following two questions: What is the relationship between local and regional climate and the glacier response? and What are the consequences of glacier changes downstream for water resource management? The processes linking meteorological and hydrological parameters and glacier changes are still not fully understood. Glacier discharge may form an important water source for local mountain communities, and it may also create risk for a glacier lake outburst flood (GLOF). The only way to seek answers to these questions is long-term glacier monitoring with process studies closely linked to the monitoring activities.

When setting up a glacier monitoring program, **international strategies and standards** must be followed. The monitoring strategy defined by Global Terrestrial Network for Glaciers (GTN-G) is designed to provide quantitative and comprehensive information to improve understanding processes related to glacier change, to detect the changes, environmental impacts as well as for model validation. This strategy is designed so that the information and knowledge produced will serve the needs of policy makers, the media, and the public, in addition to the scientific community itself.

The **Cryosphere Initiative at ICIMOD** focuses on developing and implementing cryosphere monitoring activities in a sustained manner with the partners of the initiative. Following the international monitoring strategy, the activities are categorized into three main components: field-based snow and glacier monitoring, field-based hydro-meteorological observations and monitoring, and remote sensing-based observations and monitoring. The activities under these components ensure an interdisciplinary approach to develop comprehensive assessments of glacier water resources and future water availability scenarios.

The main **parameters** for glacier monitoring are glacier extent and mass as well as regional and local meteorological and hydrological conditions. Useful **indicators** for these parameters are glacier mass balance and glacier length changes, glacier area, air temperature, precipitation, and water discharge from the glaciers. A successful glacier mass balance monitoring programme, for example, always consists of in-situ and remotely sensed mass balance monitoring, ideally complemented by other measurements such as meteorological and hydrological measurements.

A **glacier monitoring programme** should be designed with a **sustainable, long-term perspective** with a consistent methodology. Defining any trends in glacier behaviour or in climatic variables requires at least five years of continuous measurements. However, depending on the nature of the parameters, continuous time-series over decades maybe required. The monitoring activities should be distributed to represent major mountain ranges and climatic zones, and the monitored individual glacier should be carefully selected according to the monitoring principles related to its geometry and location. A good mass balance monitoring programme includes consistent field measurements on an annual or biannual basis without spatial or temporal gaps, for example. Thus, monitoring resources, such as capacity for high-quality measurements in terms of equipment and professionals, for data analysis and data sharing as well as long-term funding should be carefully assessed before implementation.

The glacier monitoring data are an essential part of the global and regional glacier inventories such as ICIMOD inventory (Bajracharya and Shrestha 2011), and required for process studies to better understand the relationship between glaciers and meteorological and hydrological parameters as well as for validation and calibration of modelling studies, for assessing the regional variability of glacial changes and representativeness of direct mass balance measurements. This all is relevant when assessing the current and future contribution of the glaciers to the water resources and their implications for the downstream communities.

Useful links

www.icimod.org/cryosphere

www.gtn-g.org/intro

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Annex 6: Community-based red panda monitoring in eastern Nepal

Damber Bista

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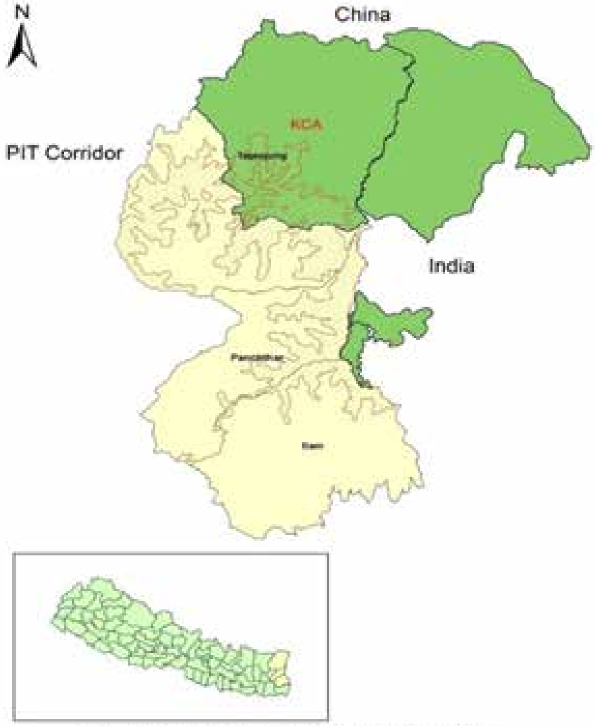
Introduction

The Panchthar-Ilam-Taplejung (PIT) corridor occupies the transboundary region in eastern Nepal. This area is recognized as a region of international importance for biodiversity conservation due to its species richness and diversity and transboundary connectivity between Kanchenjunga Conservation Area in Nepal and Singhalila National Park and Barsey Rhododendron Sanctuary in India (Williams et al. 2011). The PIT corridor is crucial for red panda conservation as it supports approximately 25% of Nepal's red panda population (Williams 2006). The Red Panda Network (RPN) aims to maintain a viable population of red pandas in the PIT corridor through a community-based conservation program. RPN is implementing this integrated conservation programme since 2011 which comprises research and monitoring, education and awareness, and sustainable livelihoods. The monitoring program is believed to be instrumental in evaluating the effectiveness of ongoing integrated conservation programme in the long run.



Proposed Community Protected Red Panda Forest

Methodology

This monitoring program is being carried out in 27 village development committees of the PIT corridor where 49 monitoring blocks have been established with a total number of 194 transects, each 1 km in length. These monitoring blocks are distributed within 33 community forests. Each transect has a concentric circular plot established at the centre with a 10m radius (Area=314.28 m^2) for trees and two other subplots of 3m radius for shrubs and bamboo (A=28.28 m^2) and 1 m radius for herbs (A=3.14 m^2).

Altogether 54 local forest users trained as citizen scientists carry out monitoring on quarterly basis in a year. They record information on red panda status (based on signs/ sightings), habitat quality, and disturbances and threats, as well as the data on distribution and abundance of other sympatric species. Some issues have been encountered during the data gathering and tabulation process while recording data manually on datasheets since the beginning of this monitoring program. Some forest guardians were recorded to be reporting the fake data without traversing across transect, it used to take nearly two to three

Forest Guardians recording data during monitoring months to collect all the data. Therefore, the mobile-based application is being integrated in ongoing monitoring programme which will streamline our collection process, produce more accurate and real-time data, reduce room for error, and provide a medium for data authentication.

Results

We have yet to analyse the data but some positive results in terms of increased abundance of red panda signs/ sightings have been reported in the recent years. Spotting cubs is being very common which was almost impossible at the time the monitoring was initiated. These evidences indicate increasing population in the PIT corridor. Besides, increased awareness and network of forest guardians spread across this corridor has also been realized to be effective in minimizing poaching induced threat.

Challenges/Opportunities

Learning based on this program indicates that the effectiveness of a community-based wildlife monitoring programme is influenced by the capacity of local forest users. Sustainability is another vital factor which should always be considered while designing any of this kind of program. Integration of monitoring activity as a part of a comprehensive conservation program may help lead towards sustainability to some extent. To sum up, learning from this program is believed to be helpful in improving existing and designing new community-based wildlife monitoring program which could be replicated in larger scale at landscape level.

Red pandas spotted during monitoring

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Annex 7: Long-term socio-ecological monitoring of forests in KSL-Nepal

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Introduction

Forests constitute almost 30% of the total area of KSL-Nepal. Long-term monitoring of forest ecosystems using a comprehensive set of interacting physical, environmental, biological, and social variables allows for the assessment of relationships among various socio-ecological components in this ecosystem. Long-term monitoring also allows for the detection of cause-and-effect relationships, especially for parameters that change over a longer timeframe. This enables for the prediction of future changes with respect to drivers of change and can subsequently be used in the development of policies for management and development interventions.

The long-term environmental and socio-ecological monitoring (LTESM) framework guides implementation of long-term inter-disciplinary monitoring in transboundary landscapes of the Hindu Kush Himalaya (HKH). In line with this LTESM framework, this work was carried out for long-term monitoring of the state and dynamics of forest ecosystems, their drivers of change, and the resulting impacts of these changes. The objectives of long-term monitoring of forests ecosystems in the KSL are:

- to enhance knowledge on forest ecosystems in the KSL by providing data from long-term forest ecosystem monitoring
- to strengthen forest ecosystem management for both ecosystem well-being, as well as human well-being, through the analysis of long-term data.

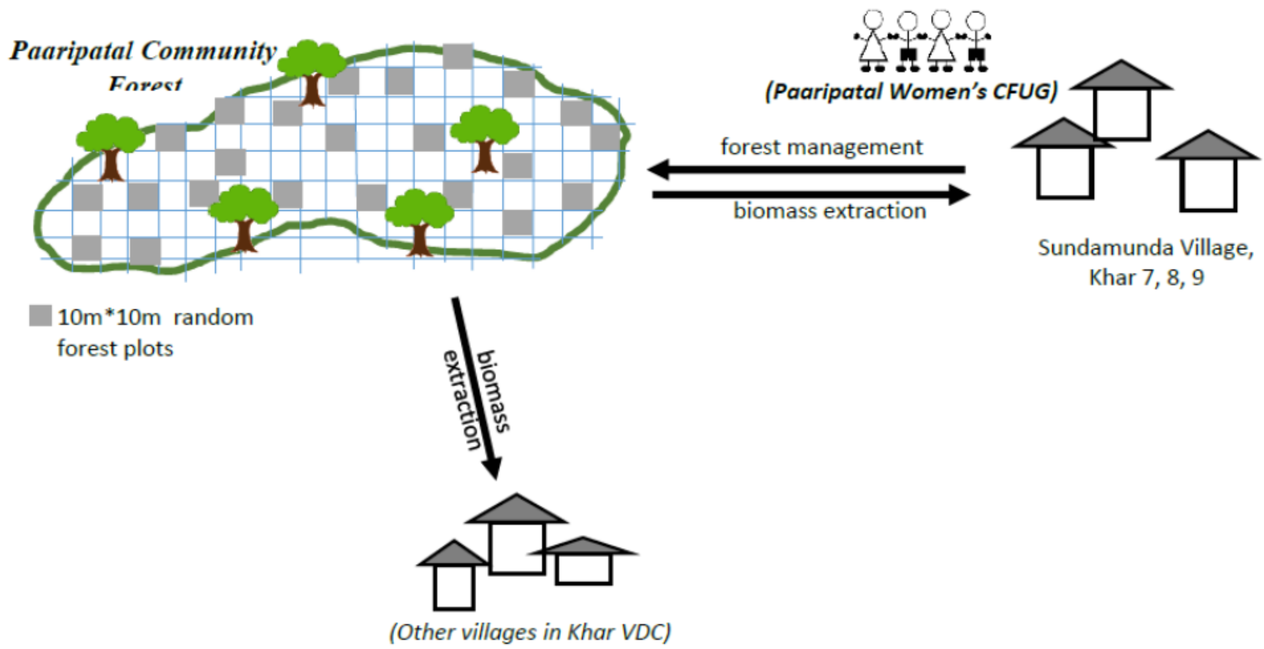
The research questions of this study were:

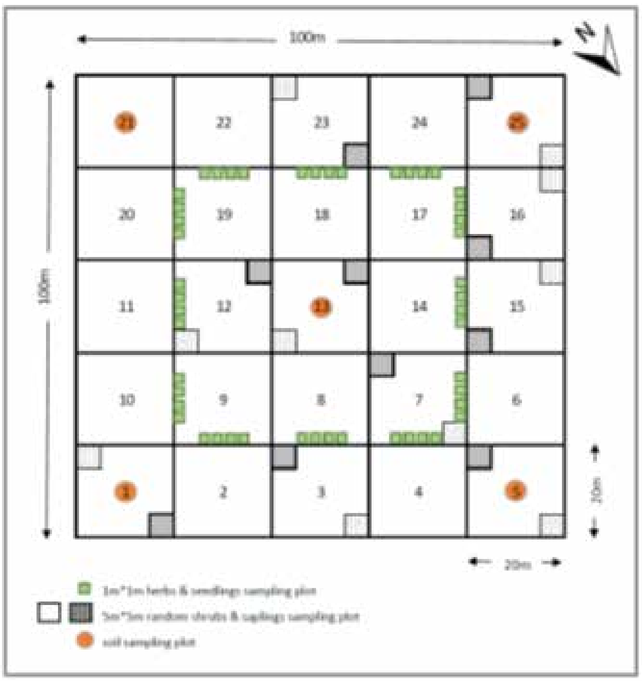
- What are the major stressors on forest ecosystems in the KSL-Nepal?
- How are species responding to changes in the ecosystem?

Methodology

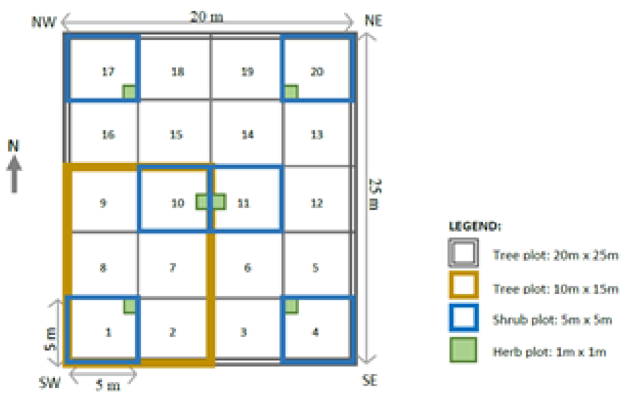
Since broadleaf and pine forest are dominant forest types of KSL-Nepal, these forests were selected for long term socio-ecological monitoring.

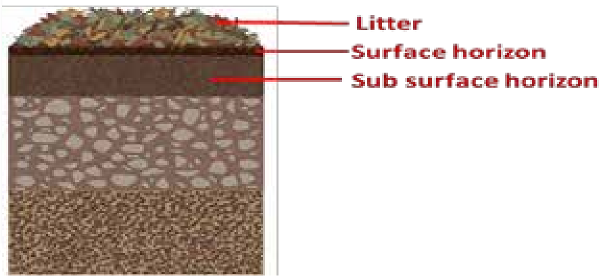
1. **Development of socio-ecological baseline:** Household survey, focus group discussion, and key informant interview was conducted to collect socio-ecological baseline data from the members of CFUG.
2. **Establishment of permanent forest monitoring plot:** Permanent plot of size 1 ha was established in Paripatal Women Community Forest located in Khar VDC of Darchula District following the protocol of international forest monitoring and of size 20 x 25 m^2 was established in Paripatal Women Community Forest and Kirmadhe Community Forest in Darchula and Kailash Kachaharikot Community Forest in Bajhang district following the protocol of Community Forests in Nepal.





Layout of 1 ha plot





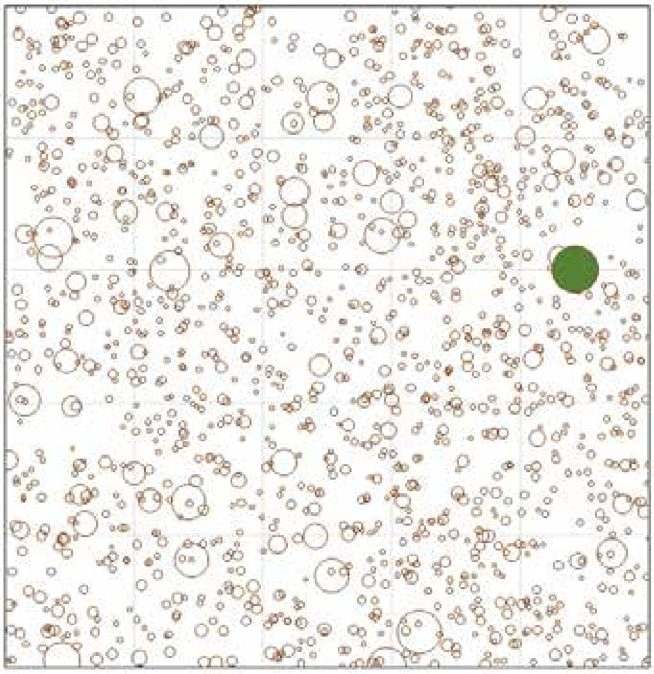
Soil sampling

Parameters noted in the permanent plot

Plot/sub-plot	Trees	Shrubs	Herbs	Seedlings
Tree plot: 20m x 25 m	dbh >10 cm			Species count
Tree plot: 10m x 15 m	4 cm <dbh ≤ 9.9 cm			
Subplot 1(5 m x 5 m)	1cm <dbh ≤ 3.9 cm			Species location height
Shrub plot 5 m x 5 m: Subplots 1, 4, 17, 20, 10 or 11		Species count % cover		
Herbs plot 1 m x 1 m within subplots 1, 4, 17, 20, 10 or 11			Species % cover	Species count

Findings

A total of 1,304 trees of 13 species were recorded. Dominant tree species were Quercus lanata (747 trees) and Lyonia ovalifolia (421 trees) which together accounted for 90 percent of the total trees in the plot. Total basal area was 61.0m^2 ha^{-1} with L. ovalifolia accounting for 66 percent and Q. lanata for 27 percent of total basal area. The size class distribution of different species showed that the forest is not disturbed and the regeneration is high.



Challenges/Opportunities

Long-term sustainability of these forest monitoring plots is a challenge, especially considering the financial implications.

There is high opportunity to engage members of local CFUGs in long-term monitoring and in using this information for further management of their respective community forests.

Annex 8: Establishment of long-term environmental and socio-ecological monitoring (LTESM) sites for wildlife monitoring in Kailash Sacred Landscape, India

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Introduction

What is being monitored?

Bans-Maitoli area of Gokerneshwergad watershed in Pithoragarh District has been selected as a pilot site for long-term ecological monitoring. This area is characterized by oak forest, chir forest, sal forest, grasslands/ alpine pastures, wetlands, and agro-ecosystems with an altitudinal range of 800m to 1,800m. Long-term monitoring plots were laid for monitoring various aspects related to 1) invasive species, 2) birds, 3) insects, and 4) mammals.

Why it is important to monitor in a long term?

Wild species and spaces are documented to be very good indicators of health of the ecosystem. Different species and spaces respond to varying regimes of management and anthropogenic disturbances. Hence, it is vital to monitor the wild species and spaces in the landscape long term to check the health of the ecosystem and ensure the services and functions continue to be provided by them undeterred and undisturbed.

What are the research questions?

Since the monitoring is done for various taxa, the research questions and methods are taxa specific. The following are some of the research questions: 1) how does the species diversity and richness change along the gradient of elevation, land use, and disturbance regimes? 2) what are the changes in species diversity and richness in different forest management practices? 3) how does the species abundance and diversity change with the forest patch size? 4) how is the forest patch size affecting the abundance and richness of interior and edge species? 5) what are the key areas for RET species in the landscape? 6) what are the patterns of invasion by an alien invasive plant Ageratina adenophora in Gokerneshwar Gad watershed, Kailash Sacred Landscape? and 7) what are the patterns of human-wildlife conflict in the landscape?

Methodology

A total of 13 permanent plots were laid in two different ecosystems (grassland and forest) and three different forest types of Bans-Maitoli village including Van-Panchayat and reserve forest sites which were proportionately distributed across different ecosystems and forest types. Out of 13 permanent plots, 2 were laid in grassland and 3 in oak forest (Van-Panchayat), 3 in sal forest (reserve), 2 in sal forest (Van-Panchayat), and 3 in pine forest (Van-Panchayat). Seven permanent transects were also laid for the monitoring of avifauna, mammals, and entomofauna. The figure shows the location of all the permanent plots and seven transects in different habitats. Furthermore, details of specific locations for monitoring in each site are provided along with taxa descriptions.

For vegetation sampling 50m x 50m area was selected and permanently marked with the help of steel tags, paint, and brush. Within, two 20m x 20m plots were selected and four corners of the plot were marked as A, B, C, and D. In each 20m x 20m plot tree girths of each tree were also measured; herbs were counted in 1m x 1m quadrate at each point. Creepers and climbers were recorded in 2m x 2m quadrate at points A and C only and 5m x 5m plots were laid for observing shrubs, seedling, and saplings on the same points.

LTM plots were also laid for Eupatorium monitoring in Bans-Maitoli. Data was also collected for mammals (camera trap and trail transect walk), birds (point count), and entomofauna (pitfall and transect walk and light trap) in the above mentioned 13 plots. Vegetation sampling was done only once.

Findings

Invasive species: 1) Major lopping for fodder was from sal forest (reserve forest) and cutting for fuelwood was from pine forest (Van-Panchayat), 2) Highest abundance of Eupatorium was recorded in north-facing slope between elevations 1,700m–1,800m asl, 3) Highest cover of this invasive species was recorded in fallow land (69.97%), followed by grassland (18.67%), edges of agricultural fields (9.10%), and forests (2.26%), 4) Abundance and occurrence of Eupatorium was inversely proportional to the distance from the village, 5) In north-facing slope, a nearly 41% stretch along the road was infested with Eupatorium and distance from the road was inversely proportional to its cover, and 6) Similarly nearly 82% of the area along stream courses was colonized by Eupatorium.

Insects: About 23 species of butterflies, 12 species of moth, and 8 species of beetles have been identified in LTESM plots.

Birds: A total of 109 bird species were recorded in different seasons from the study in different habitats. Among them 78 are resident; 30 species (26 summer and 4 winter visitors) are altitudinal migrants, whereas one species status is unknown. The maximum average density, diversity, and richness of birds was found in agro-ecosystem in all seasons except the spring season. Banj oak forest was the second most abundant and diverse in all seasons of study area, followed by sal, chir pine, and grassland. It was also revealed that species diversity differed significantly in different habitats, but not significantly in different seasons. A multiple linear regression model predicts that shrub cover and grass cover significantly influence the diversity of birds.

Mammals: It was found that five of six villages suffered heavy loss of crops due to wild pigs. Our assessment showed about 30%-70% crop damage, costing up to 12,000 Indian rupees (in 2016, 178 US dollars) per year. Rhesus macaque (38%) and porcupine (30%) were ranked among the most harmful species by the farmers. The villagers lost a total of 32 livestock (goats and cows) to wild carnivores (common leopard and Asiatic black bear). Wild pigs were most common in all the forests followed by rhesus macaque, barking deer, Himalayan langur, and common leopard. The results suggest that the distance of villages from the forested area is an important factor in determining the extent of crop damage by wild animals. Porcupine and rhesus macaque were considered the most harmful species to agricultural crops in the villages located beyond 0.5 km of the forests. However, pigs caused maximum crop damage in the villages located within 0.5 km of the forests. Wheat was the least preferred crop by wild pig. Guarding and night watching are the two most effective mitigation methods used by villagers.

Challenges

The rugged terrain and forest fire were the challenges faced during LTESM.

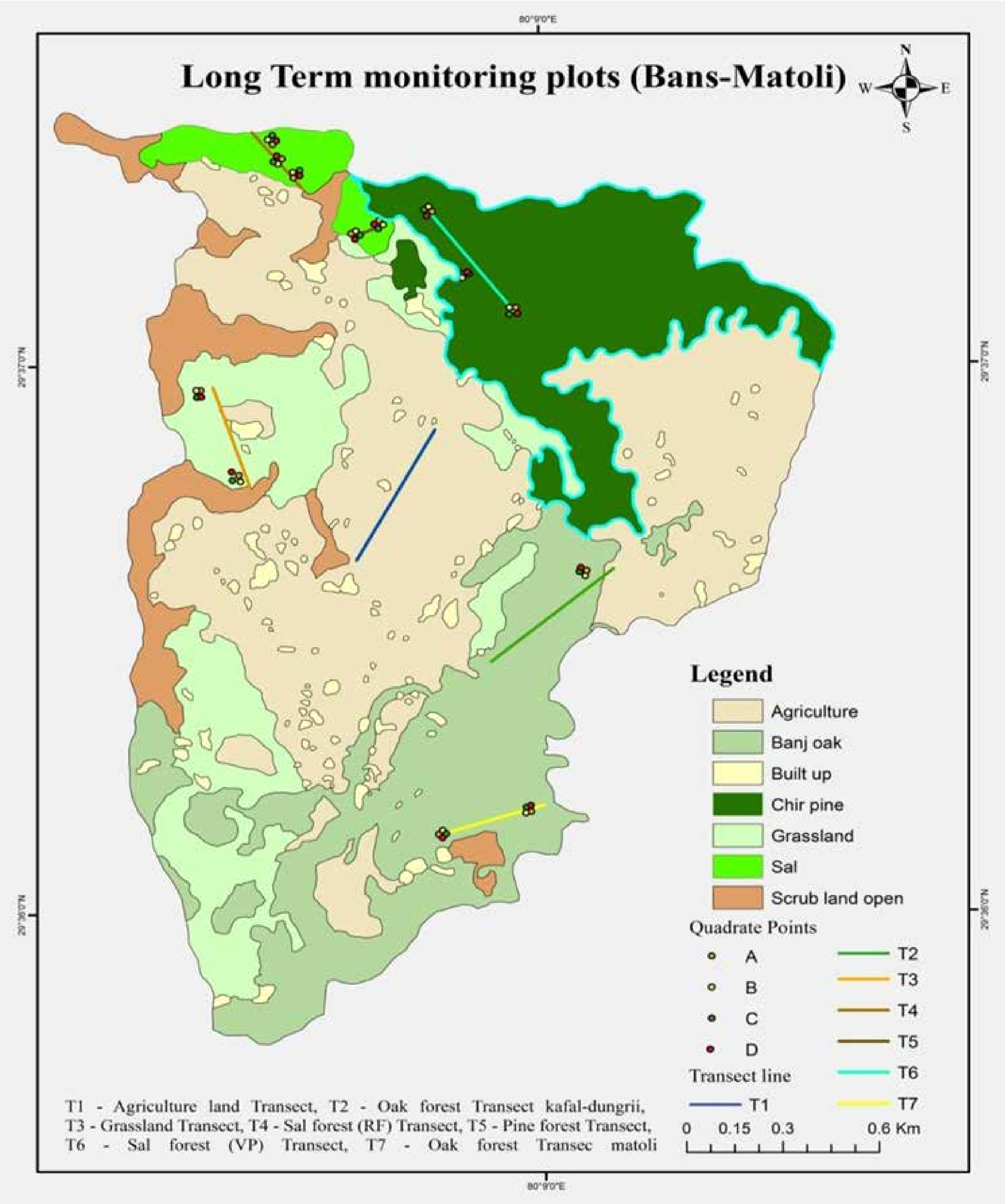

Figure: Locations of permanent plots and transects in pilot site

Annex 9: Methodology and approach for spring revival

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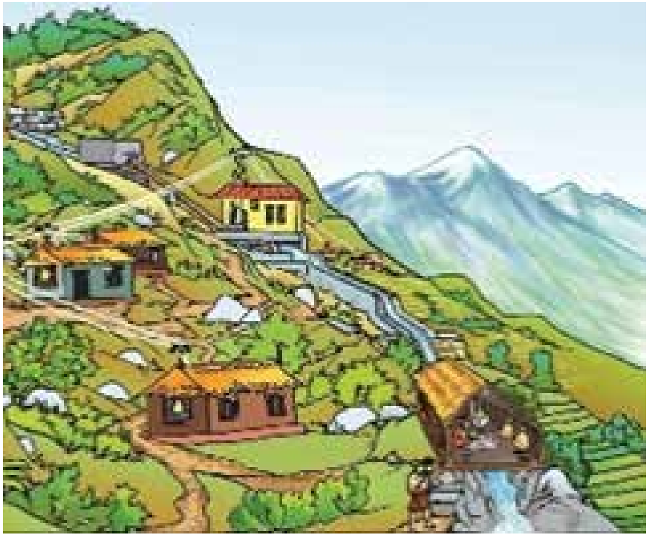
Advanced Center for Water Resources Development (ACWADAM), Pune, India

Introduction

Springs, also called dhara, mool, kuwa, naula, and chasma, are the most important source of water for millions of people in the Hindu Kush Himalaya (HKH). Spring water is used for drinking, irrigation, domestic, and religious purposes. Springs are also important for ecological functions like supporting local vegetation and wildlife and maintaining base flow in rivers. In the HKH, springs are drying up, leading to acute water stress. This evidence is largely anecdotal as few systematic and scientific studies have been conducted on this topic. Climate change, especially rainfall, land and land use changes, and socioeconomic and demographic changes are the main reasons for springs drying up. Drying of springs leads to drinking and domestic water insecurity in rural and urban areas, irrigation water insecurity in hills, and poor ecosystem services (e.g., low base flow and human-wildlife conflicts).



The Eight-Step Methodology

Given the importance of springs, lack of scientific studies, and growing evidence that springs are drying or their discharge is declining, researchers and practitioners from the HKH came together in December 2015 in Gangtok, Sikkim, in a workshop organized by ICIMOD and ACWADAM and collaboratively developed a common methodology for understanding the science, social science, and implementation activities needed for revival of springs (Figure 1). The methodology integrates aspects of physical and social sciences. It is useful for researchers and field practitioners and relatively easy to follow. Each step generates scientific information and allows implementers to invest in infrastructure to revive springs. This methodology is now applied by ICIMOD and its partners through the CGIAR Research Program on Water, Land, and Ecosystems in Dailekh and Sindhupalchowk (Nepal); in Nainital district of Uttarakhand, India, through the HI-AWARE project (in Nuwakot District, Nepal, and Darjeeling district, West Bengal, India); and the Kailash Sacred Landscape Conservation and Development Initiative (Darchula District, Nepal, and Uttarakhand, India).

Research questions

1. Why are springs drying and what can be done to revive them?
2. What are the social and governance aspects of spring management?
3. What are the impacts of drying springs and related consequences at spatial and regional scales?

Figure 1: The eight-step methodology for spring revival

The methodology combines aspects of research and knowledge generation (steps 1–4) and implementation (steps 5–8). Those interested only in knowledge generation can adopt the first four steps; but for implementation, all eight steps are needed.

1. Comprehensive mapping of springs and spring sheds	5. Creating a conceptual hydrogeological layout of spring shed
2. Setting up a data monitoring system	6. Classification of spring types, identifying mountain aquifer and recharge area
3. Understanding social and governance aspects	7. Developing spring shed management protocols
4. Hydrogeological monitoring	8. Measuring hydrological and other impacts of spring revival activities

Challenges while Conducting Long Term Research

- Reservations in data exchange due to data sharing policies of some nations
- Ensuring good quality reliable data generation from the field
- Sustaining long-term monitoring and research

Opportunities for Outscaling

It is expected that this methodology will be applied in all countries of the HKH in the coming five years. ICIMOD's future strategy for outscaling includes:

- Generation on knowledge using a comparable methodology
- Training of partners, both local community partners and implementation partners
- Hosting the Regional HKH Spring Network
- Research collaboration with institutions like the British Geological Society
- Linking science with policy and practice

Annex 10: Monitoring forest resources of Nepal using permanent sample plots established for forest resource assessment

Shiva Khanal

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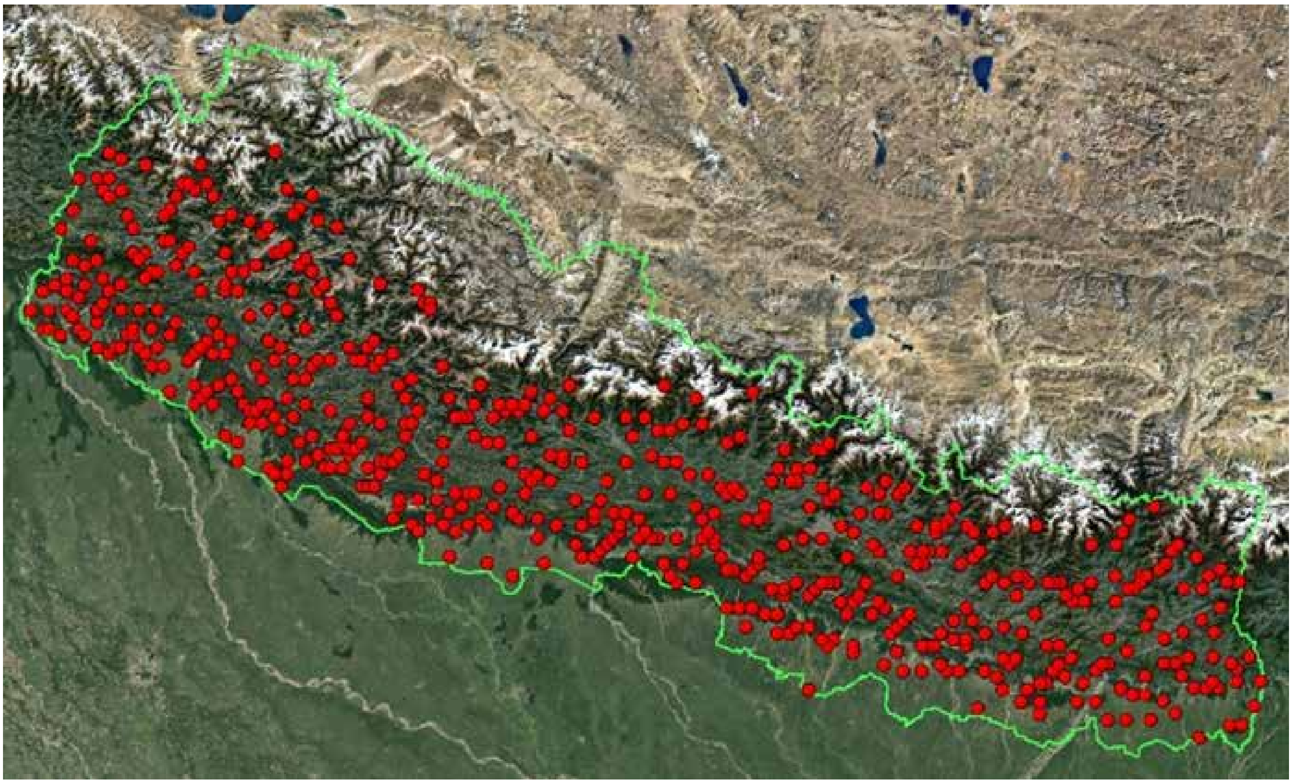
Ministry of Forests and Soil Conservation, Government of Nepal

Introduction

Department of Forest Research and Survey (DFRS) has been conducting national scale forest resource assessment periodically. The recent assessment was completed between 2010 and 2014 with a joint effort between the Governments of Nepal and Finland. Unlike the previous assessments, which focused solely on timber, this is a comprehensive assessment in terms of forest resource data generation. In addition to quantification of forest stock, it included estimation/mapping of spatial coverage, non-timber products, soil characteristics, and biodiversity indicators. This also included protected areas in the sample site which were excluded before. More important, one of the key features is establishing measurement plots as a permanent sample plot for periodic monitoring.

Methodology

Altogether 2,544 permanent sample plots (PSPs) were established across Nepal. No visible marking has been set on the plot so that the intervention and/or management within plot does not differ from other adjacent forest areas. Standard set of well-documented field instructions have been adopted for measurement and re-measurements later. For re-measurement, the plot centre was navigated using geographical coordinate reference, physical reference features recorded and small metal peg inserted at the centre and covered. The PSP establishment and measurement started from 2010 in Terai and gradually progressed up in mountains. Therefore, last year it was five years since the measurement of plots in Terai and re-measurement was done for Terai plots. This year's plan is to measure plots in Churia and gradually progress towards mountain in coming years.



Spatial distribution of permanent sample plots across Nepal

Findings

The data from PSPs has provided important insight into forest stock, soil carbon, disturbances, and biodiversity indicators. DFRS has published the results and the data are being used by different stakeholders. One of the major annual activities has been to re-measure those PSPs to maintain the interval of five years. In the case of Terai, due to the flat terrain and ease of access, finding and re-measuring the earlier established plots was relatively easy. The data analysis that is underway will provide important insight into the changes in forest resources over time.

Challenges/Opportunities

It is expected that the PSP re-measurement in mountains and high mountains will be more demanding due to terrain, weather conditions, and financial considerations. This endeavour will require better planning and collaboration with partners to make best use of resources. The information from repeated measurements will be helpful not only for requirements such as REDD+ MRV but also for understanding how Nepal's forest from the Terai to mountains is changing over time. This will provide an important information base to guide policy, strategic planning, and sustainable forest management.

Annex 11: Long-term socio-ecological monitoring of rangelands in China: Case study in the Qilian Mountains

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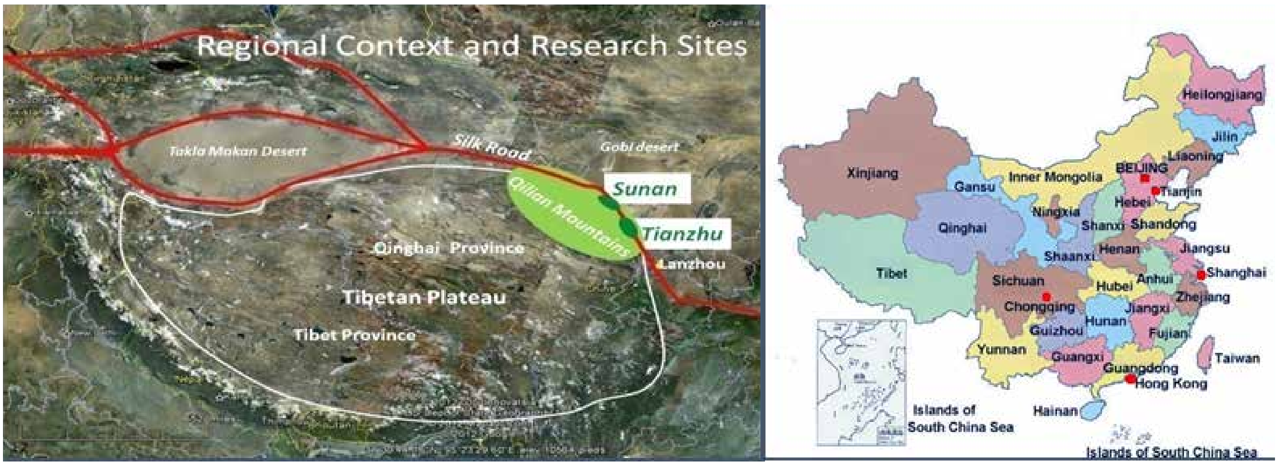
Summary

The Qilian Mountains is located in the northeast edge of the Qinghai-Tibetan Plateau. Due to the harsh climatic conditions, yak and sheep breeding is the main agricultural activity in this area. The great challenge in the Qilian Mountains is to find a sustainable rangeland management approach to avoid further rangeland degradation while improving livelihoods of herders.

Since 1983, the dynamics of socioeconomic and environmental changes in local pastoral communities have been identified and documented through interviews with herders, local officials, and literature reviews in Sunan and Tianzhou Counties of the Qilian Mountains. In 1983, the Household Contact Responsibility System (HCRS) was started in the Qilian Mountains.



Map: Working areas in the Qilian Mountains

From 1982 to now, the same 50 herder-farms in each county were continually interviewed and documented for documenting dynamics of socioeconomic and environmental changes, including climate change, pastoralism management system, food security, education, migration, marketing and livelihood development, multidimensional poverty of the households, policy impacts, and so on.

Results show that in general, the pastoral system in Sunan Yugu County is more stable and productive compared with Tianzhu Tibetan County. Animal species and management strategy, resource availability, and policy effectiveness have the most influence on livelihood development and sustainability of the local mountain society.

The sustainability of the socioecosystems in the Qilian Mountains relies on comprehensive understanding of interactions of climate change, rangeland productivity, interests of households, market demand, local governance, and national policy effectiveness. Long-term socio-ecological monitoring of pastoralism in the Qilian Mountains is crucial for understanding as well as prediction and decision making of various stakeholders.

Annex 12: Stocktaking of data based on monitoring framework for Kangchenjunga Landscape

Key questions	Parameters	Indicators	KL-Bhutan					KL-India					KL-Nepal				
			Data availability					Data availability					Data availability				
			Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks Data accessibility data frequency etc.
Ecosystems																	
What are the major stressors on ecosystems in an area?	Biomass extraction	Amount of biomass removed (fuelwood, timber, fodder, NTFP, leaf litter)	Y	Quantitative Fuelwood: TLs, Nos, MCu Timber: Nos, CFTS NTFPs: Kgs, Nos, HHs	District National	District / FIMS	Accessible on quarterly and annual basis	Y	Quantitative Qualitative	Village PA	Forest Dept – Sikkim, WB GBP ATREE	Irregular Insufficient Research articles	N				
	Grazing pressure	Livestock stocking rate	Y	Quantitative Population: Nos Production: Kgs	District National	District / DoL	Accessible on annual basis	Y	Quantitative (HH survey) Qualitative	State – Sikkim Alpine and trans-Himalaya Point data (case studies, research articles)	Sikkim: Forest Dept, Animal Husbandry TMI India		Y	Partial data available	District	DLDO, MoFSC, RPN, ICIMOD	Only one-time data available
	Alien invasive species (IAS)	Unproductive land area due to AIS Decline in native species due to AIS	?					N					N				
	Climate change	Change in climate variables	Y	Temp: max, min Rainfall Relative humidity	District National	Dept of Hydromet, MoEA	Accessible on daily basis on request	Y	Temp: max, min Rainfall Wind direction, speed Humidity				Y	GLORIA data	Four mountain summits (site specific)	CDB/TU	
	Natural hazards	Incidence of droughts, floods, and fire	Y	No. of incidences	District National	DoFPS DDM DHMS	Accessible on annual basis	Y	No. of landslides and fire incidents				Y	Partial data available on fires and floods		WWF ICIMOD	
	Land use and cover change, including habitat fragment-ation	Change in land use and land cover, including infrastructure	Y	Quantitative: % change	National	MoAF (Land Cover Mapping Project 2010)	Accessible	Y	Remote sensing and GIS data				Y			ICIMOD WWF	

Key questions	Parameters	Indicators	KL-Bhutan					KL-India					KL-Nepal				
			Data availability					Data availability					Data availability				
			Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks Data accessibility data frequency etc.
	Illegal trade of high-value wild products	Populations of high-value wild products	Y	Quantitative: kgs, nos.	National	DoFPS	Accessible on annual basis	Y	Quantitative data of illegal trade				Y	Partial data – red panda, high-value NTFPs		WWF RPN DNPWC DoF	
What is the status of HWC and how is it changing?	Wildlife status Livestock status Land use pattern Demography	Number of cases Crop productivity Loss of lives											Y	Partial data		RECAST WWF NTNC	
Cryosphere and Water																	
What is the impact of climate change on the cryosphere?	Cryosphere	Snow cover (thickness and duration), glacier area, melt water yield	?					Y	Satellite data				Y	Snow cover Glacier area		ICIMOD	
How is water availability changing at the local level?	Water availability	Amount of water available for human use (including livestock and crops) Water quality Water deficit for human use Soil moisture deficit for plant growth	?					Y	Amount of water Water quality		Springs Dhara Vikash		Y	Partial data: water availability, water quality (Kabeli)		MoPE DoE	
Ecosystem services																	
How are ESs changing in the land-scape?	ES supply (provisioning, regulating, cultural)	Status and change in quality and quantity	Y	Quantitative Qualitative	District National	District FIMS NEC DHMS	Accessible on annual basis	Y	Baseline quantitative and qualitative data				Y	Partial data: water, NTFPs		WWF	One-time data available Status of some NTFPs available
Which ecosystems are used by local communities?	ES demand (provisioning, regulating, cultural)	Consumption of ES or benefits received from ES by local people and downstream beneficiaries						Y	Pollination Pasture management Medicinal plants Cultural Ecotourism				Y	Partial		ICIMOD	

<table>
<tr><th rowspan="3">Key questions</th><th rowspan="3">Parameters</th><th rowspan="3">Indicators</th><th colspan="5">KL-Bhutan</th><th colspan="5">KL-India</th><th colspan="5">KL-Nepal</th></tr>
<tr><th colspan="5">Data availability</th><th colspan="5">Data availability</th><th colspan="5">Data availability</th></tr>
<tr><th>Y / N</th><th>Data type brief description</th><th>Data scale HH/district/ landscape/ others</th><th>Data source</th><th>Additional remarks data accessibility data frequency etc.</th><th>Y / N</th><th>Data type brief description</th><th>Data scale HH/district/ landscape/ others</th><th>Data source</th><th>Additional remarks data accessibility data frequency etc.</th><th>Y / N</th><th>Data type brief description</th><th>Data scale HH/district/ landscape/ others</th><th>Data source</th><th>Additional remarks Data accessibility data frequency etc.</th></tr>
<tr><td>Is ES supply sufficient to meet demand?</td><td>Demand and supply ratio of ecosystem services</td><td>Demand and supply</td><td>Y</td><td>Quantitative</td><td>District National</td><td>District FIMS</td><td>Accessible on annual basis</td><td>N</td><td></td><td></td><td></td><td></td><td>N</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="8">Is eco-system structure sufficient to supply desired ESs?</td><td rowspan="8">Vegetation, food web and soil structure</td><td>Amount and cover of plant litter on ground (forest and grassland)</td><td rowspan="8">Y</td><td rowspan="8">Quantitative</td><td rowspan="8">National</td><td rowspan="8">FRMD (DoFPS)</td><td rowspan="8">Accessible

2017 (MIDS) State of forestry report</td><td>N</td><td></td><td></td><td></td><td></td><td>Y</td><td>Partial data</td><td rowspan="8">Sparse distribution of sites for data</td><td>DFRS</td><td></td></tr>
<tr><td>Forest canopy cover</td><td>N</td><td></td><td></td><td></td><td></td><td>Y</td><td></td><td>DFRS</td><td></td></tr>
<tr><td>Vegetation biomass</td><td>N</td><td></td><td></td><td></td><td></td><td>Y</td><td>Partial data</td><td>DFRS</td><td></td></tr>
<tr><td>Herbivore biomass</td><td>N</td><td></td><td></td><td></td><td></td><td>N</td><td></td><td></td><td></td></tr>
<tr><td>Predator biomass</td><td>N</td><td></td><td></td><td></td><td></td><td>N</td><td></td><td></td><td></td></tr>
<tr><td>Pollinator abundance</td><td>Y</td><td>Abundance in large cardamom</td><td></td><td></td><td></td><td>N</td><td></td><td></td><td></td></tr>
<tr><td>Extent of bare soil</td><td>N</td><td></td><td></td><td></td><td></td><td>Y</td><td>Partial data</td><td>ICIMOD</td><td></td></tr>
<tr><td>Soil organic layer depth</td><td>N</td><td></td><td></td><td></td><td></td><td>Y</td><td></td><td>DFRS</td><td></td></tr>
<tr><td colspan="18">Biodiversity (flora and fauna)</td></tr>
<tr><td rowspan="3">How are species (keystone and flagship) responding to changes?</td><td>Plant phenology</td><td>Flowering and fruiting pattern</td><td>Y</td><td>Ad hoc</td><td></td><td>NBC</td><td>Accessible (but ad hoc)</td><td>Y</td><td>Plant phenology pattern (irregular)</td><td></td><td></td><td></td><td>N</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Species composition and habitat conditions and change (elevation)</td><td>Vascular plant community composition at monitoring sites</td><td>Y</td><td>Dominance Diversity</td><td>Permanent monitoring plots</td><td>UWICER</td><td>Accessible</td><td>Y</td><td>Vegetation pattern along elevation gradient (case studies)</td><td></td><td></td><td></td><td>Y</td><td>Partial data on diversity from GLORIA sites</td><td></td><td>RECAST
CDB
WWF</td><td></td></tr>
<tr><td>Status of Red List species</td><td>Change in species numbers, population size, age composition, sex ratio and distribution</td><td>Y</td><td></td><td>National</td><td>NBC</td><td>Accessible on annual basis</td><td>Y</td><td>Scattered data</td><td></td><td></td><td></td><td>Y</td><td>Partial data on red panda, snow leopard, threatened flora, endemic flora</td><td></td><td></td><td></td></tr>
<tr><td colspan="18">Socioeconomics</td></tr>
</table>

Key questions	Parameters	Indicators	KL-Bhutan					KL-India					KL-Nepal				
			Data availability					Data availability					Data availability				
			Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks Data accessibility data frequency etc.
How is the social fabric of local communities changing?	Demo-graphic changes Out-migration	Family composition Gender role (changed workload)	Y	HH information (incl. female headed)	District National	NSB (BLSS)	Accessible on 5-year basis	Y	Partial decadal demographic data Baseline data on outmigration				Y	National census data HH data in pilot sites		CBS RECAST	
What is the state of poverty and how is it changing?	% population living below poverty line Water access Modern energy access	Change in % of population Change in access to water and energy	Y	% pop. living below poverty line Access to electricity, solar, safe drinking water	District	NSB (BLSS, PAR, MPIR)	Accessible on 5-year basis	Y	Census data		Dept of Statistics and Economics		Y	National census data		CBS	
How are agricultural practices changing?	Arable area Unutilized agricultural area % agricultural area under irrigation Use of pesticides, inorganic fertilizers Employment in agriculture (% women in agriculture) Cropping intensity Livestock density (LSU)	Change in arable area Amount of use of pesticides Agriculture diversity Change in employment numbers Change in cropping pattern and LSU	Y		District DAO	District / MoAF	Accessible on annual basis	Y	Case studies				Y	National census data		CBS MoA	
How is economic status of local communities changing?	Socio-economic status	Changes in source and level of income (standard of living, exp. pattern, landholding, livestock holding)	Y	Mean monthly HH consumption Distribution of HHs by landholding, livestock holding	District	NSB (BLSS) MoAF (RNR Annual Reports)	Accessible on annual and 5-year basis	Y	Case studies				Y	Partial data from national census		CBS MoA	
	Local resource based income and employment	Vulnerability (wealth indicator) and availability of ESs	?										Y	NTFP-based income Agroproducts (partial) Red panda-based ecotourism		KCAMC/ WWF MoA DoT RPN	

Key questions	Parameters	Indicators	KL-Bhutan					KL-India					KL-Nepal				
			Data availability					Data availability					Data availability				
			Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks Data accessibility data frequency etc.
What are the perceived changes on environment, conservation, and development?	People's perceptions	Local perception on climate change (temperature and rainfall pattern, related adaptation), wildlife conflict, availability of resources, dependence on resource, entrepreneurship and income	Y	Management Plan	Landscape	DoFPS	Accessible on 5-year basis	Y	Case studies				Y	Case studies		RECAST ICIMOD WWF Thesis: TU, KU	
Technology																	
How do innovations and advance-ment of new technologies impact improved livelihoods and ensure ecological integrity?	Alternative energy sources: Solar drier Solar lamp Improved stoves Micro hydropower	Innovation and best practices incorporated Disasters and related risks reduction Increased use of integrated planning and management support systems	Y	Assessment Report (HWC mitigation measures)	District	MoAF / NPPC	Accessible						Y			WWF	
Policy																	
How do policy interventions impact ecosystem management and sustain ecosystem services?	State of the policies	Access to ES, equitable benefits sharing, and increased inter-sectoral coordination in management for ES	N			ABS policy in place, but no data		Y	Data policy on organic farming				Y	Partial data		DoF DFO	
	Policy influences	Enhanced productivity and increased biodiversity co-benefits in production systems (forest, rangeland, wetland, agriculture)	Y		District DoFPS	DoFPS	Accessible on annual basis	N					Y	Partial data		REDD Cell	

Key questions	Parameters	Indicators	KL-Bhutan					KL-India					KL-Nepal				
			Data availability					Data availability					Data availability				
			Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks data accessibility data frequency etc.	Y / N	Data type brief description	Data scale HH/district/ landscape/ others	Data source	Additional remarks Data accessibility data frequency etc.
Have there been any policy change recently? If yes, what are those?	Changes in policy provision that can potentially impact ecosystem and access for local communities	Changes in policy provisions	?					N					N				
Institutions and governance																	
How do or can local (both modern and traditional) institutions ensure efficient, equitable and sustainable resource use?	Effectiveness of the institutions	State of resources, sharing of benefits to all category and classes of community, rules restricting consumption, monitoring and sanctioning, plans and practices (regular meeting, monitoring)	Y	CF / LMPs, cooperatives Ops	District	District / DoFPs	Accessible on annual basis	Y	Traditional institutions: Dzumsa in Lepcha communities				Y	Partial data		DFO DNPWC KCAMC	
How do institutions deal with inter and intra community sharing of benefits and conflict resolutions?	Institutional set up and communi-cation	Existence and functioning of forums for intra and inter benefit sharing, number of meetings	Y		District	District / DoFPs	Accessible on annual basis	N					Y	Partial data		DFO DNPWC KCAMC	

Annex 13: **Future references persons on LTESM indicators**

Wetlands and rivers	Forests	Grasslands	Agro-ecosystems
Damber Bista	Bir Bahadur Khanal Chettri	HK Badola	Kailash Gaira
Gopi GV	Bishnu Hari Wagle	Khadga Basnet	Kamal Aryal
MS Lodhi	Chandra Subedi	Muhammad Ismail	Kamala Gurung
Sanjeev Bhuchar	Jianwen Li	Ram P Chaudhary	Namgay Bida
Santosh Rayamajhi	Nimit Verma	Ruijun Long	Ruijun Long
Zhu Dan	Prabin Bhandari	Srijana Joshi	Santosh Chettri
	Sesh Kanta Bhandari	Suresh Ghimire	Wu Ning
	Shiva Khanal	Yi Shaoliang	
	Shraddha Sigdel	Zhao Xinquan	
	Suman Bhattarai		
	Sunita Pradhan		
	Tashi Tobgyel		
	Ugyen Tshering		
	Ugyen Tshering		
	Yeshey Jamtsho		

Annex 14: KLCDI KM&C Strategy 2016–18

Purpose	Objectives	Resources
To guide communication processes and media interventions of the Kangchenjunga initiative and among stakeholder groups at transnational levels as a prerequisite and a tool for change. **'Ultimately: To further the trust amongst the partners for long-term sustainable cooperation and effective implementation'**	**O 1:** Support and further the effectiveness of the activities identified in the pilot sites **O 2:** Increase efficiency of flow of information to, from, and amongst all Kangchenjunga program partners and important stakeholders, as well as among functional committees/governance mechanism at national and regional levels **O 3:** Raise public profile of the program (with identified target groups, locally, nationally, regionally, globally) **O 4:** Ensure effective lobbying and advocacy with diverse project stakeholders	**Human resources:** Dedicated **KM&C focal points** at ICIMOD and at partner level: Bhutan: Ms Namgay Bidha India: Dr HK Badola Nepal: Prof. Dr Ram P. Chaudhary ICIMOD: Dr Janita Gurung **Financial resources:** KLCDI budget allocations to partners Partner regular budget allocations GIZ additional budget allocation

Identified key KM&C priorities for IV 2016, 2017, and 2018 (sequence by importance)

Priority 1: KM&C for Partner Cooperation and Coordination	
• Regular regional planning and sharing meetings	ICIMOD with all — immediate, yearly
• Regular country planning and sharing meetings	All lead partners — regularly yearly
• Exposure trips to other partners	ICIMOD leads (I-2017)
• Common updated website	ICIMOD and selected partners — immediate, regularly
• Fact sheets of partners	ICIMOD lead with all (I/2017)
• Mentorship program	ICIMOD/TBL/GIZ (end 2017)
Priority 2: KM&C for Implementation	
• Training with Training manuals for capacity building at community level	ICIMOD, India, Nepal (whole 2017)
• Multidisciplinary exposure trips with expert group	ICIMOD (end 2017)
• Exposure trips for communities	Partners lead with NGOs (in 2017)
• Exposure trips (across border)	ICIMOD leads (second half 2017)
• Capacity building posters and flyers	ICIMOD and partners lead (first half 2017)
Priority 3: KM&C for lobbying of project	
• Meetings for lobbying: At all levels by all partners at all occasions	Case studies: From mid 2017 onwards in all countries
• Reports: Regularly as by demand by all partners (see Excel sheet)	Research papers: End 2017 and end 2018 — lead by ICIMOD

Priority 1: Implementation Local Custodians and Local Stakeholders

- Trainings
- Training manuals
- Multidisciplinary exposure trips
- Exposure trips
- Capacity-building posters/flyers
- Mobile-based communication

+

Priority 2: Partner Cooperation / Coordination

- Regular regional planning and sharing meetings
- Regular country planning and sharing meetings
- Exposure trips to other partners
- Common updated website
- Fact sheets of all partners and important stakeholders
- Mentorship program

+

Priority 3: Lobbying

- Government bodies, development agencies,
- global audience
- Meetings
- Reports
- Case studies
- Research papers

Integrated strategies for at least six value chains and relevant microenterprises are identified, strengthened, and promoted	Action plans for ecosystem management are developed/ implemented/ strengthened	Integrated schemes for coping with human-wildlife conflicts are strengthened and implemented	Ecosystem-based incentive mechanisms developed and implemented	Mechanisms for long-term environmental and socio-ecological monitoring strengthened	Regional Cooperation Framework (RCF) for KL endorsed by KL member countries	Knowledge products on KL developed and communicated	Regional platform established for KL/ Knowledge generation and contribution to relevant national, regional, and global agenda-setting process

Outcome: Livelihoods and ecosystems management are improved in a sustainable and equitable manner in selected areas of the KLCDI region

Impact: The Kangchenjunga Landscape is better conserved and managed for sustaining ecosystem goods and services to improve livelihoods and enhance ecological integrity, economic development, and sociocultural resilience to environmental changes

= Expected Kangchenjunga initiative impact

Messages about KLCDI

Richest landscape in terms of culture and biodiversity 60–8,000m altitude
Kangchenjunga landscape ➔ scenic, beautiful, endemism, snow leopard
Chance for conservation of yak genetics (breeding management biggest besides China)
All components covered: social wellbeing of population, transboundary issues, ecosystems
Learning across borders possible: transboundary challenges and changes high
Agriculture and forest hand in hand ➔ positive aspect
Most challenging landscape with immense biological and cultural diversity
Kangchenjunga Landscape Sikkim as World Heritage Site since July 2016

Pilot sites of KLCDI

Nepal: Sidin, Panchthar – argeli VC, ecosystem management
Maipokhari Ilam – wetland ecosystem RAMSAR
Bahundangi Jhapa – bayleaf, lemon, tourism VC, ecosystem management
India: Ribdi (Sikkim) and Gorkhay (WB) – cattle dairy and tourism VC; forest and agroecosystem management
Dzongu (North Sikkim) – tourism VC, forest and agro-ecosystem management
Bandapani, Jalpaiguri (West Bengal) – tourism and vegetable VC, forest and agro-ecosystem management
Bhutan: Haa – ecotourism and yak rangeland ecosystem management
Gedu – cane, chili, multi-tier systems, ecosystem management
Samtse – ginger, multi-tier system

Priority transboundary topics for partner exchange exposure trips: Human-wildlife conflict (expertise Nepal); conservation and biodiversity management – ecosystem management (expertise India); transboundary joint patrolling (expertise India)

Bhutan

PARTNERS

Wildlife Conservation Division, Department of Forests and Park Services, Ministry of Agriculture and Forests - *Implementation Partner*
Forest Division Paro
Forest Division Haa
Agriculture Department
Department of Livestock

OTHER IMPORTANT STAKEHOLDERS

India

PARTNERS

Ministry of Environment and Forests (MoEF-GOI) - Strategic partner
G.B. Pant Institute of Himalayan Environment and Development - Coordination partner - *Implementation Partner*
Forest Department Sikkim
Forest Department West Bengal
ATREE (Sikkim-based NGO)
TMI (Sikkim-based NGO)
MLAS (Sikkim-based NGO)
HNAF (West Bengal-based NGO)

OTHER IMPORTANT STAKEHOLDERS

Nepal

PARTNERS

Ministry of Forests and Soil Conservation (MoFSC, GoN)
Tribhuvan University/RECAST - Coordination partner - Implementation Partner
Ministry of Agriculture Development
Environment, Planning and Monitoring Division
District Forest Office Ilam
District Forest Office Jhapa
District Forest Office Panchthar
OTHER IMPORTANT STAKEHOLDERS
Department of National Parks and Wildlife Conservation (DNPWC)
Department of Plant Resources (DPR)
Department of Hydrology and Meteorology (DHM)

KLCDI KM&C Strategy 2016-2018; Update: November 2016

PRIORITY 1: Communication instruments for cooperation and coordination amongst partners																	
WHAT	**HOW**	**WHO**										**WHEN**					**ADDITIONAL INFO**
		BHUTAN			**INDIA**					**NEPAL**		2016	2017		2018		
	ICIMOD	**FD**	Agricultural department	Dept. of livestock	**GB Pant Sikkim**	**FD WB**	**FD Sikkim**	NGO WB	NGO Sikkim (TMI, ATREE)	**MoFSC**	**RECAST**	IV	I-II	III-IV	I-II	III-IV	**Additional info**
Regular regional planning and sharing meetings	L	x	x	x	x	x	x	x	x	x	x		IC, All		IC		
Regular country planning cum sharing meetings	x	L	x	x	L	x	x	x	x	L	x		Bh, In, Np		Bh, In, Np		All countries: yearl country planning and exchange meetings with stakeholders
Exposure trips to other partners	L	x			L	x	x	x	x				IC				IC to lead and Bh would facilitate within the country.
Common updated website	L	L	x	x	L	x	x	x	x	L	L	IC, Np	IC, Np	IC, Np	IC, Np, In	IC, Bh, Np	ICIMOD and all country partners take lead to update own websites regularly
Fact sheets of partners	L	L	x	x	x	x	x	x	x	x	x		IC, All				
Mentorship programme	L	x			x	x	x	x	x					IC			

KLCDI KM&C Strategy 2016-2018; Update: November 2016

PRIORITY 2: Communication and knowledge sharing at Implementation level

WHAT	HOW	WHO										WHEN					ADDITIONAL INFO
		BHUTAN			INDIA					NEPAL		2016	2017		2018		
	ICIMOD	FD	Agricultural department	Dept. of livestock	GB Pant Sikkim	FD WB	FD Sikkim	NGO WB	NGO Sikkim (TMI, ATREE)	MoFSC	RECAST	IV	I-II	III-IV	I-II	III-IV	
Trainings	L	L	x	x	L	x	x	x	x	x	L		IC, In	IC			Bh: tImeline would be spread across the years and trainings conducted on need basis
Training manuals for capacity building	L	L	x	x	L	x	x	x	x	x	L		IC, In, Np				Bh: tImeline spread across the years and trainings conducted on need basis
Multidisciplinary exposure trips with expert group	L	L	x	x	L	x	x	x	x	x	x		Bh, IC	IC, In,			IC lead for internatinoal exposure groups; Bh: for Bbutanese partners exp.
Exposure trips for communities	L	L	x	x	L			L	L	L	x		In, Bh	IC, Np			
Exposure trips (across border)	L	L	x	x	x	x	x	x	x	x	x		IC, In, Np, Bh				
Capacity building posters		L	x	x	L			x	x	x	L		In, Np				Bh: posters would be developed as and when felt necessary
Flyers	L	L	x	x	L			L	L	x	L		IC, In, Np	Bh			
Mobile based communication		L	x	x	L	L		x	x	x	L			In, Np			

KLCDI KM&C Strategy 2016-2018; Update: November 2016

PRIORITY 3: Communication and knowledge sharing for lobbying																	
WHAT	**HOW**	**WHO**										**WHEN**					**ADDITIONAL INFO**
		BHUTAN			**INDIA**					**NEPAL**		**16**	**2017**		**2018**		
	ICIMOD	**FD**	Agricultural department	Dept. of livestock	**GB Pant Sikkim**	**FD WB**	**FD Sikkim**	NGO WB	NGO Sikkim (TMI, ATREE)	**MoFSC**	**RECAST**	IV	I-II	III-IV	I-II	III-IV	
Meetings for lobbying (yearly functions)	L	x	x	x	x	x	x	x	x	L	x		Np		Np	Bh	
Reports	x	L	x	x	L			L	L		L	In, Ne, Bh	In, N, Bh			Bh	
Case studies	L	L	x	x				L	L	L	L		In, Ne, Bh	IC, Np		IC, Np, Bh	
Research papers	L	L	x	x						L	L			IC, Np		IC, Np, Bh	

Attachments to the Strategy

Attachment 1: Basic guiding principles on KM&C by KMC division ICIMOD and links to ICIMOD repository

Attachment 2: Cornerstones – extracts of relevantconcepts, policies and strategies
- ICIMOD and the Transboundary Landscape concept
- ICIMOD KM&C Strategy
- A brief ICIMOD Data Policy
- Principles of Partnership of ICIMOD Partnership Strategy
- ICIMOD Gender Equity Policy

Annex 15: Individual participant feedback on the workshop

What was 'wow' experience?	How will this conference be useful to you?	How will the information and the network given to you be useful?	What needs to be improved in future?
	We learned how to conduct workshops and fulfill objectives from the workshop	We will get benefitted from all information to help and guide locals	Himalaya Hotel pick-up for Indian participants (oh no)
Presentation, activities, road map, methods and discussions	It will be helpful to use the learning for teaching conservation based students	Really as academic background, it will be great elements for preparing the quality/ experience base knowledge to students and among other stakeholders	We have made some continuation. Tomorrow a complete road map will be prepared to crosscheck and improve with field verification. It is needed to reassemble in days to come.
Group work; field trip	Being a stakeholder, the conference helped me and my institution to share and learn among LD countries	Website, journals, articles	More meaningful participation, right person in right place, more collaboration among stakeholders
Presentation from participants, workshop preparation and beautiful landscape	I am clearer about how to do it in our own initiative	We will use the framework to design our own matrix.	Pay more attention to the quality on scientific strengths of the indicators chosen.
Discussing and sharing experience and knowledge from different nations	I hope we can do some cooperation on biodiversity and extension in my project	Can through email or connect with ICIMOD	Nice
Group work and presentations	Understanding LTESM and its significance helps in creating future support from institutions	References	Information
For developing methods			Nothing specific although there is always room for improvement
Field work	This particular conference will help me in designing and developing methodologies in future for HILIFE	The information will be helpful to provide knowledge to support implementation of HILIFE	.
Friendly environment during the whole period and lots of fun	To develop protocols for long-term monitoring sites within landscape	Will be useful on understanding the basis for adaptation and integration and for preparing and sharing plans	I feel some more time to be given for the whole program (extend workshop time)
	Will be able to do the monitoring work		
Interaction, participatory orientation workshop conducted by ICIMOD	Socio-ecology will be used in programs here, priorities LTESM will be more useful for myself and my institutions	Will be able to implement the learnings	Time management, field trip should be relevant, cookies during tea were a bit boring and constant
	Working in forestry sector (REDD+) so it is beneficial for me in developing my capacity and knowledge in terms of long-term monitoring.	From the development of further methodologies and long-term monitoring sites	
Got some useful information on monitoring of various ecosystems	Know more information from regional experts and institutes	Useful reference	Time management
Overall 'wow,' although at times it was not so	Implementation of LTESM	Future reference and networking with experts	Time was too short and such workshop of importance should be done over a longer duration
Program design, activities and learning	Learning and collaboration	Learning, planning and implementation	Very good

Expectation fulfilled	Experiences / knowledge be disseminated	Can be shared with my colleagues in the field	Time management
Multidisciplinary knowledge from a single program	Further collaboration for this pioneering work in transboundary issues has been explored		
Presentations on permanent sample plots, local inventory	Collaboration, network, sharing expertise	Teaching and research activities	Everything is good
All the presentations, gathering and discussions were fruitful for building the road map for LTESM	Definitely the outcome of this workshop will be a valuable asset for future study in Nepal, as per our organisation, we are hoping soon for a concrete guideline	Information will certainly be helpful for community development in targeted communities	Time management
LTESM framework with road maps would considerably contribute to address UN SDGs.....	Strengthened local mechanism and capacity in LTESM	Sharing and capacity development for colleagues in conservation	None
	For knowledge mgt and communication, for developing common methodology, learning from regional experts and experiences	For implementing landscape projects and plans efficiently	Some more discussions on methodologies

Annex 16: Workshop program

Regional Orientation on Long Term Environmental and Socio-ecological Monitoring

Day 1: Monday, 14 November 2016		
	Travel to Pokhara from Kathmandu and Transfer to hotel	
14:45–15:00	Registration of KLCDI partners for KM&C Strategy development	Rekha Rasaily
15:00–17:00	KLCDI participants only: Finalization of priorities for assuring structured communication through KLCDI Knowledge Management and Communications Strategy	Heike Junger-Sharma
17:00–17:30	Registration of all participants	Rekha Rasaily
17:30–19:00	**Inaugural session** Chief Guest: Prof Dr Tirth Raj Khaniya, Vice Chancellor, Tribhuvan University	
	Welcome Introduction of participants Transboundary Landscapes Program: Opportunities and Challenges for mainstreaming LTESM Workshop objectives Remarks: India Remarks: Nepal Remarks: Bhutan Remarks: China Remarks: GIZ Remarks from Chief Guest Vote of thanks	Prof Krishna Tiwari, Dean, IoF-TU Self-introductions Dr Nakul Chettri, ICIMOD India Nepal Bhutan China Manfred Seebauer, CTA Dr Rucha Ghate, ICIMOD
19:00–20:30	Reception dinner	Co-hosted by IoF and ICIMOD, Shangri-la Village Resort
Day 2: Tuesday, 15 November 2016		
09:00–09:30	Getting Started: Expectations, Introductions, Rules and Roles	Heike Junger-Sharma
09:30–14:30	**Technical Session 1** Long-term monitoring in the hkh region: Experiences, opportunities and challenges Session Chair: Prof Ram P Chaudhary	Rapporteurs: IoF and ICIMOD
09:30–10:00	Setting the stage: The LTESM Framework for TBLs Presentation (10+10 minutes) Discussion (10 minutes)	Dr Nakul Chettri and Dr Rucha Ghate, ICIMOD
10:00–11:00	KEYNOTE PRESENTATION: Nepal's experience in long-term monitoring along an altitudinal gradient: Linking forest ecosystems with community socio-economic dynamics Presentation (40 minutes) Discussion (20 minutes)	Dr Santosh Rayamajhi and Dr Bir Bahadur Khanal, Institute of Forestry, Tribhuvan University
11:00–11:15	Tea break	
11:15–11:40	Rangeland monitoring in China Presentation (15 minutes) Discussion (10 minutes)	Prof Zhao Xinquan, Chengdu Institute of Botany, Chinese Academy of Sciences
11:40–12:05	Monitoring responses of alpine vegetation to climate change using the GLORIA methodology in the Nepal Himalaya Presentation (15 minutes) Discussion (10 minutes)	Dr Suresh Ghimire, Central Department of Botany, Tribhuvan University
12:05–12:30	Long-term monitoring of peatlands in China's Hongyuan Wetlands Presentation (15 minutes) Discussion (10 minutes)	Dr Zhu Dan, Chengdu Institute of Botany, Chinese Academy of Sciences
12:30–13:30	Lunch	
13:30–13:55	Glacier monitoring in the Himalayas Presentation (15 minutes) Discussion (10 minutes)	Dr Anna Sinisalo, ICIMOD

13:55–14:20	Wildlife monitoring in the Eastern Himalaya: Community-based monitoring of the endangered red panda Presentation (15 minutes) Discussion (10 minutes)	Damber Bista, Red Panda Network
14:20–14:30	Remarks and closing of session by the Chair	
14:30–17:10	Technical Session 2 Sharing experiences on long-term monitoring from transboundary initiatives Session Chair: Prof Zhao Xinquan	Rapporteurs: IoF and ICIMOD
14:30–15:50	Long-term monitoring in TBLs: progress, challenges and opportunities Poster presentations and Discussion	
14:30–15:10	Forest LTESM in Kailash Sacred Landscape, Nepal	Chandra Subedi, RECAST
	Wildlife monitoring in KSL, India	Dr Gopi G.V., WII
	Springs monitoring	Dr Sanjeev Bhuchar, ICIMOD
15:10–15:50	Interactive posters: Preparing monitoring stories	Group work and presentations
15:50–16:05	Tea break	
16:05–16:30	Permanent forest monitoring in Nepal Presentation (15 minutes) Discussion (10 minutes)	Shiva Khanal, Department of Forest Research and Survey, MoFSC
16:30–16:55	Long-term socio-ecological monitoring of rangelands in China: Case study in the Qilian Mountains Presentation (15 minutes) Discussion (10 minutes)	Prof Ruijun Long, ICIMOD
16:55–17:05	Remarks and closing of session by the Chair	
17:05–17:15	Feedback on the day	Heike Junger-Sharma with participants
17:15–17:25	Preparations for field visit on Day 3	IoF
Day 3: Wednesday, 16 November 2016		
09:00–13:00	Field visit Long term forest monitoring site of Institute of Forestry – Hemja, Pokhara. Visit IoF Campus.	
13:00–14:00	Lunch	
14:00–15:30	**Technical Session 3** The Status of monitoring in the Kangchenjunga Landscape	Rapporteurs: ICIMOD and IoF
14:00–15:30	Country-wise stock-taking of monitoring progress in KL countries Group work, presentations and discussions	
	Nepal	MFSC, RECAST
	India	GBPNIHESD, ATREE, TMI
	Bhutan	WCD
15:30–15:40	Remarks and closing of session by the Chair	
15:40–17:30	Endorsement of KLCDI KM&C Strategy (KLCDI partners only)	Heike Junger-Sharma
Day 4: Thursday, 17 November 2016		
09:00–15:15	**Session 4** Socio-ecological systems and gender and governance	Facilitators: Dr Rucha Ghate and Dr Kamala Gurung Rapporteurs: ICIMOD and IoF
09:00–11:25	Analyzing social systems and understanding socio-ecology through gender and governance perspectives using participatory approach	Dr Rucha Ghate, Dr Kamala Gurung, Kamal Aryal, ICIMOD
	Presentations Group exercises	
11:25–11:45	Tea Break	
11:45–16:00	Session 5 Developing a road map for LTESM in Transboundary Landscapes	Group facilitators: Wu Ning; Yi Shaoliang; Nakul Chettri

11:45–13:00	Group work on developing road map: Group I: HKPL Group II: KL Group III: Hi-LIFE What will we monitor in the long term? In KL country-wise sub-groups (Bhutan, India, Nepal): Where will we monitor? How will we monitor? Also identify gaps in information. Who will be involved in managing and implementing the long-term monitoring system? (Stakeholder mapping) What will be the data sharing mechanism?	KSL participants will be distributed among 3 landscapes HKPL, KSL and Hi-LIFE participants will be distributed among 3 KL countries
13:00–14:00	Lunch	
14:00–15:00	Continue and finalize group work	
15:00–16:00	Group presentations (20 minutes each) Group I: HKPL Group II: KL Group III: Hi-LIFE	
16:00–16:30	Tea Break	
16:30–17:00	Next steps	Dr Nakul Chettri, ICIMOD
17:00–17:45	Concluding session	
	Remarks: India Nepal Bhutan China Concluding remarks Vote of thanks	Dean, IoF Dr Nakul Chettri, ICIMOD
Day 5: Friday, 18 November 2016		
	Travel to Kathmandu from Pokhara	
End of Programme		

Annex 17: Participant list

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