



International Conference on
**Wild Harvests, Governance and
Livelihoods in Asia**

Kathmandu, Nepal

30 November-02 December 2017

Abstracts

Organizers

Transiting to Green Growth: Natural Resources in Nepal
Science and Power in Participatory Forestry

Co-Organizer

Ministry of Population and Environment, Government of Nepal

Partner institutions



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Venue

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Partner Institutions

Tribhuvan University, Institute of Forestry and Central Department of Botany, Nepal

Faculty of Agriculture, Agriculture and Forestry University, Nepal

University of Copenhagen, IFRO and IGN, Denmark

Kunming Institute of Botany, CAS, China

Aarhus University, Denmark

Sokoine University of Agriculture, Tanzania

Federation of Community Forestry User Groups Nepal

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Organizers

Transiting to Green Growth: Natural Resources in Nepal (TGG-N Project) is working on conservation and trade of medicinal and aromatic plants (MAPs), which has the potential to drive the transition to a green economy by promoting sustainable resource use, generating inclusive employment, and contributing to poverty alleviation. However, lack of empirically-based knowledge renders this transition difficult. This research project will investigate how the transition to green growth can be undertaken in the MAP sector in Nepal. The sector involves millions of people and has potential to promote pro-poor employment and earnings as well as sustainable resource use. The project focuses on (i) identifying, describing and quantifying transnational production networks for MAPs traded in and from Nepal to India and China, and (ii) socially equitable employment potential by identifying points of intervention that enhance inclusive job creation, increase earnings and their redistribution, and promote sustainable resource use. Data is generated through transnational production network actor interviews, from harvesters through traders to end consumers and regulatory bodies, and ecological inventories. The project is developed and managed by the University of Copenhagen, the Federation of Community Forestry Users in Nepal, Tribhuvan University and the Agriculture and Forestry University in Nepal, and the Chinese Academy of Sciences. Project outcomes will inform the development of policies and strategies for transiting to green growth in natural resource sectors in low income countries. Outputs include international peer-reviewed papers, policy briefs, strengthening Nepalese partners' human and social capital, and sector-wide stakeholder participation.

Science and Power in Participatory Forestry (SCIFOR) is a research and education capacity development project implemented in partnership between four institutions in three continents. In Denmark, the Department of Food and Resource Economics (IFRO), University of Copenhagen is one of Europe's largest research environments on development and natural resources management. This is bolstered with additional ethnographic expertise by the Department of Culture and Society (DCS), Aarhus University, Denmark. The Faculty of Forestry and Nature Conservation (FFNC), Sokoine University of Agriculture, is by far the largest forestry research and educational institution in Tanzania (<http://www.forestry.suanet.ac.tz>). The Institute of Forestry (IOF),

Tribhuvan University is the first and foremost higher level forestry research and educational institution in Nepal (<http://iof.edu.np/>) (<http://www.iofpc.edu.np/>). The project runs for the period 2014-18 and is financed by the Danish Consultative Research Committee on Development Research. The SCIFOR project profile can be accessed via the University of Copenhagen website at <http://www.ifro.ku.dk/scifor>. Overall, in a nutshell the SCIFOR project investigates politics in the production, circulation, and application of scientific knowledge guiding forest management in Tanzania and Nepal. The project was conceived out of the observation that scientific forestry knowledge that originated in central Europe in early 19th century, initially for taxation purposes, remains the standard today also in Participatory Forest Management (PFM) processes. The problems with implementation of PFM are inadequate funding, plans not based on rigorous inventories, unclear whether management plans are used, unclear whether PFM forests generate values that justify the costs of intensive inventories, just to mention a few. Despite all these problems, the framing of PFM in technical and procedural terms endures.

Ministry of Population and Environment, Government of Nepal is the focal ministry for environment and population. The ministry is working in the sector of population management, renewable energy, hydrological studies, environment and climate change and environmental conservation. Few of the major objectives of the ministry is promoting the green growth concept in development activities and promoting enhanced use of renewable energy.

Conference Theme

This conference aims to bring together researchers, practitioners, and policy makers concerned with the conservation and use of wild harvested environmental products in Asia, from timber to medicinal plants and wildlife products. Participants will interact and share ideas and findings through research papers, posters, discussions, and the conference excursion. The conference is made up of two days of presentations and discussions followed by the conference excursion/field visit to Chandragiri Hill outside Kathmandu. In addition, the conference venue in central Kathmandu provides direct access

to an ancient city with an exceptional cultural heritage. Kathmandu can be reached by a number of international flights and provides a wide range of choice in terms of accommodation. The conference will take place at the Hotel Annapurna in central Kathmandu (where room discounts are available). Participants are encouraged to seek funding from their possible sources; the organizers have available funding to support participation of a limited number of participants (selected based on request and quality of submitted abstract).

Themes

1. **Collection, Marketing and Trade (CMT)** covers aspects from harvesting to end consumers, including value chains and global production networks.
2. **Conservation and Sustainable Use (CSU)** addresses issues from estimating single species harvest limits to obstacles to macro-level conservation planning.
3. **Policy and Governance (PG)** aims at identifying institutional challenges to improvements in livelihoods and conservation outcomes.
4. **Livelihoods (L)** strives to increase our understanding of the role of wild products in households' wellbeing, income generation and asset building.

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Keynote Address

Conservation and Sustainable Harvest of Wild Plant Resources: Lessons Learned, Opportunities, and Challenges

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Abstract

Wild plant resources are heavily used and traded across Asia for foods and medicines, construction, art, ceremony, among other uses. It is estimated that hundreds of millions of people worldwide depend on the sustainable harvest of wild plants to help meet their subsistence needs and support their livelihoods. In the early 1990s the sustainable harvest of wild plants came to forefront in conservation initiatives, as harvest was proposed as a win-win conservation and development strategy. Since then there has been a growing body of research -and lot of debate - over the ecological implications of wild plant harvest. I draw on recent reviews and meta-analyses to present some of the traits and contexts that make plants vulnerable or resilient to wild harvest. I then present several case-studies from Asia to highlight some of the major lessons learned to date in terms of sustainable harvesting, and to discuss opportunities and challenges.

Plenary Session

Medicinal and Aromatic Plants: Quantifying Nepal's Top Export Item

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Abstract

For centuries, there has been a huge cross-border trade in medicinal and aromatic plants (MAPs) from Nepal, traditionally driven by demand in India and, in recent years, in China. Moving beyond anecdotal evidence and smaller case studies, limited in terms of number of products and geographical coverage, this study quantifies the national-level trade in MAPs from Nepal. It is based on a trader survey in 15 districts, conducted in autumn 2015 and spring 2016. Findings show that the largely invisible trade in MAPs constitutes Nepal's most valuable export product group.

Key-words: non-timber forest products, trade, global production networks, income

Rethinking the Role of Forestry

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Abstract

Forestry is the way we conceive of, demarcate, measure, manage and manipulate landscapes with trees. Throughout its long history since being conceived of in 18th century central Europe, forestry has served the needs of rulers and elites more than the needs of people living in rural landscapes with trees. In this paper, I examine the role of forestry over time, the challenges it has met with, and its remarkable resilience to changing demands from society. In doing this I draw on environmental history accounts of forestry, as well as more contemporary examinations of forestry from the perspective of political ecology. I provide examples from across the World to illustrate my arguments. I end with posing some ideas for how forestry and foresters could become more relevant to the broad publics that they seek to serve.

Key-words: forest management, political ecology, environmental history,

Promoting Entrepreneurship (Livelihood) and Human Welfare with focus on the Himalayan Region

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Abstract

The Indian Himalayan Region (IHR) covers an area of about 5 lakh km² (about 16.2% of country's total geographical area) and forms the northern boundary of the country. The IHR shows a thin and dispersed human population due to its physiographic condition and poor infrastructure development. There is also a high concentration of tribal people in IHR. Forest-based activities provide livelihood and employment in both formal and informal sector in this region. The Himalayan region and its people are facing multiple challenges due to ecological degradation and depletion of the forest resources, climate change which render it very important to provide adequate economic sustenance and livelihood opportunities to the people for checking their migration towards the cities and towns. Research and Development and pilot programs on producing high value products, innovative livelihood options and income generation strategies for people of this region will go a long way in helping the people of the IHR to cope with the environmental as well as the socio-economic changes. Forest Research Institute has over the last few decades developed many innovative technologies which have been adopted by farmers in agro-forestry, products formulation and value addition to non-wood forest products for their livelihood improvement and other stakeholders including cottage industries are also taking benefit of these technologies towards building up of entrepreneurship in the region. These all technologies are eco-friendly and cost effective as well and are being regularly extended to various stakeholders of the forestry sector through capacity building and technology transfer. This paper presents these technologies in detail and how they are being used and can be used in future for livelihood generation and peoples' well-being.

Managing Mushroom for Mountain Futures

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Abstract

As the mountain ecosystem and society undergoes a rapid transition, there is much uncertainty associated with the complex interplay of the major drivers of climate change and globalization and their impacts on agriculture, natural resources, and ecosystem functioning. These challenges include low or decreased productivity on smallholder farms with monoculture of food and cash crops. Smallholder farmers continue to have little access to markets and relatively insignificant influence in value chains. This is mainly due to farmers (and in particular ethnic minorities and women) having little decision power and innovative capacity. Total farm income remains relatively low and many families still live under poverty line. Mushrooms have long been exploited as resources in household economy because of their important household nutrition, medicinal and commercial uses. In eastern Himalayan region, wild harvesting and mushroom cultivation provides a much-needed alternative source of income for rural households. Facilitating mushroom growing in wild habitats and agricultural landscape has great contribution to household nutrition, income and environmental integrity. It is crucial to document traditional ecological knowledge, and develop place-based scientific knowledge, therefore promotes those hybrid knowledge, which combines local and outside knowledge for landscape restoration and livelihood development in Himalayan region. We propose mushroom project as a seeds for better mountain futures.

Conservation and Bioprospecting of Unexplored Medicinal and Aromatic Plants

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Abstract

India is well known treasure house has tremendous diverse group of biological resources. Globally, India is one among the eight mega biodiversity countries in the world that has forest cover as well as possesses 4 out of 35 hot spots in the world. Medicinal plants diversity is rich, about 70% of medicinal and aromatic plants (MAPs) are found in tropical and subtropical forests rest 30% are found in the temperate and high-altitude forests. According to Botanical Survey of India (BSI), 93% of wild medicinal plants used for making medicines are endangered, of which 335 have been assigned Red List status ranging from critically endangered, endangered, vulnerable to near-threatened. India has the second largest share of tribal population of about 53 million people from 550 tribal communities. There are about 6,500 traditional medicinal plants used as folklore medicines whereas around four to five hundred species were under common usage. Several species possessing various active principles have own identity to cure various ailments by various ethnic tribes. Recent increasing attraction of herbal medicine put tremendous pressure on the natural habitat. Scientific exploration on conservation and bioprospecting besides novel molecules *in-vitro* synthesis by using elicitors, down streaming, scaling up, study of biological activities phytomolecules/compounds/formulations and action mechanism as well as alternative plant resources is not yet completely attempted. Therefore focus on unexplored, under explored medicinal species is an important aspect to meet our day to day needs.

Theme 1: Collection, Marketing and Trade

(Oral presentation)

CMT-O 01

Generating a Population List of Medicinal and Aromatic Plant Processors in Nepal

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Abstract

Thousands of tons of Medicinal and Aromatic Plants (MAPs) are harvested in Nepal Himalayas and almost all are exported from Nepal in terms of volume in crude, essential oils, wild food, spices and other forms. No studies has been conducted to estimate national level domestic consumption of indigenous Nepalese MAPs though the numbers seems hundreds of herbal processors scattered throughout the country. Here, we generate a comprehensive and contemporary list of industries that process MAPs, using raw Nepalese MAPs totally or partially, sourced and filtered from printed and online databases of different stakeholders working in the sector of medicinal plants in Nepal. A total of 325 herbal processing companies were listed, out of which 233 were functional and 92 were with unknown current address and status. A total of 108 MAPs processors were sampled and interviewed both quantitatively and qualitatively including top 10 larger companies. The study also develops a typology of MAP processors based on end-products, size and sales volume, use of technology. The national number of processors appears to have expanded rapidly in the last few years. Here, we present the method and the population data that are used for deriving the national processors list.

Key-words: medicinal and aromatic plants, processors, national list, domestic consumption.

CMT-O 02

**Recognizing Indigenous Traders Services
on MAPs in Nepal**

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Abstract

Conservation of biological diversity (CBD) has become the global agenda. The role of Non-Timber forest products (NTFPs) and Medicinal and Aromatic plant (MAPs) is growing day by day. It is said that there is no single plant which has no medicinal value. There are number of state and non-state institutions as well as individuals are being involved in the marketing and trade of NTFPs and MAPs in Nepal. This paper presents the status of how indigenous traders ' *Jadibuti Ba Amma* ' are engaged in NTFPs and MAPs trade and providing services in and outside Kathmandu Valley. Primary and Secondary information were collected. Literature review conducted on access and benefit sharing on genetic resources (ABS on GR) initiatives by government and key informants' interview were done for collecting information on present status of indigenous trader, bottlenecks and ways forward. It is recommended that nationwide management information system (MIS) on indigenous MAPs traders should be established. Further, the third objective of CBD, fair and equal access and benefit sharing on genetic resources (ABS on GR), should be brought into action through ABS law as soon as possible. Moreover, there is an urgent need to be established a coordination body among government, non-state institutions and indigenous traders.

Key words: CBD, NTFPs, indigenous trader, assess and benefit sharing, MIS.

CMT-O 03

Medicinal and Aromatic Plants: Quantifying Nepal's Top Export Item

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Abstract

For centuries, there has been a huge cross-border trade in medicinal and aromatic plants (MAPs) from Nepal, traditionally driven by demand in India and, in recent years, in China. Moving beyond anecdotal evidence and smaller case studies, limited in terms of number of products and geographical coverage, this study quantifies the national-level trade in MAPs from Nepal. It is based on a trader survey in 15 districts, conducted in autumn 2015 and spring 2016. Findings show that the largely invisible trade in MAPs constitutes Nepal's most valuable export product group.

Key-words: non-timber forest products, trade, global production networks, income.

CMT-O 04

An Enumeration of Traded Medicinal and Aromatic Plants of Nepal

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Abstract

Economic importance of medicinal and aromatic plants (MAPs) is huge in Nepalese context, yet comprehensive studies to list all traded products at the species level is lacking. Trade of unidentified or wrongly identified MAPs may pose severe conservation consequences and loss of revenue to the government. The study broadly enumerates the traded MAPs in and from Nepal, analyze the distribution pattern and conservation aspects; which could be a milestone in developing related policies and plans for research and economic development. We use both primary and secondary data: primary data collected from nationwide field surveys in 21 districts during May 2015 to September 2017, and secondary data collected from published data on trade and distribution of MAPs. Conservation status of medicinal plants was analyzed using data on altitudinal range, life form, traded part and market demand. We listed 365 species of traded MAPs: including flowering plants ($n = 323$), non-flowering plants ($n = 41$) and rock exudate ($n = 1$). The traded MAPs were organized in 103 families and 227 genera; Orchidaceae ($n = 31$) and *Dendrobium* ($n = 18$) respectively being the family and genera with the highest number of traded species. Altitude ranging from 700 m to 1300 m have highest commercial MAPs diversity ($n = 129$ or more) and almost 63% commercial MAPs are distributed throughout Nepal in specific altitudinal range. Traded species include 149 herbs (41%) excluding lichens and mushrooms, and further underground parts or whole plant is

harvested from 167 species, posing threat to their survival because of the existing premature and over-harvesting practices. Wild MAPs remain the major source of harvest (almost 91% in terms of species richness) demonstrating their dominance in trade despite cultivation of highly traded species like *Cinnamomum tamala*, *Sapindus mukorossi*, *Zanthoxylum armatum* and *Swertia chirayita*. Since wild MAPs are harvested by poor rural communities, the trade has a huge potential to alleviate rural poverty. Newly introduced traded species showed the changing preference of consumers towards herbal products. The trade, however, may result several conservation issues since large number of medicinal plants are still harvested from wild.

Key words: conservation, altitudinal gradient, cultivated, wild harvest, trade.

CMT-O 05

Annual Financial Loss from the Community Forest in Nepal: A Case Study from Western Hill District of Nepal

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Abstract

The research estimates forgone benefits from community forests based on a case study in two community forests of the western hill district in Nepal. We conducted forest inventory following the Community Forest Inventory Guideline, 2008 and compared inventory results of the operational plan. Likewise, we also consulted community forests user groups, executive members and forest officials along with a review of the operational plan and harvesting records. We found that growing stock volume of community forests was under-estimated to align with the national average. However, our inventory results show that growing stock volume is significantly higher than the current estimate. Furthermore, the annual allowable harvest of forest products, especially timber and firewood was arbitrarily reduced. We estimated that community could harvest nearly three times higher volume of forest products, especially timber annually, compared to the current harvesting. As a result of this, local communities have forgone annual income of nearly two million Nepalese rupees from each community forests at the user price, which would even increase by twenty folds when estimated at the market price. We conclude that this has not only resulted in a huge financial loss to both community and state but have also undermined sustainable forest management principle. This further raises questions about the need for forest inventory in managing community forest when harvesting decision is based on administrative rationalities.

Key words: sustainability, loss, inventory, community forest.

CMT-O 06

Who Consumes End Products Containing Kutki in Nepal?

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Abstract

Rhizomes of *Neopicrorhiza scrophulariiflora* (hereafter kutki as common trade name) have medicinal properties and are highly traded in Nepal, India and China. What drives demand of Kutki in Nepal is unknown, the knowledge of which is important because it can allow insights into future demand and associated issues such as the likely sustainability of future trade. In this context, this study conducted market survey and a survey among consumers of medicines ($n = 44$) containing kutki ($n = 513$) in five different cities in Nepal during September 2016 to July 2017 using structured questionnaires. Out of 44 consumer products containing Kutki, 42 products were categorized as Ayurvedic medicines. Men and women of any age and with different socio-economic profiles were found to consume Ayurvedic medicine containing kutki to treat a panoply of different illnesses. The consumption of Ayurvedic medicine containing Kutki is most often guided by a doctor's prescription.

Key-words: *Neopicrorhiza*, buyers, consumers, Nepal.

CMT-O 07

Harvest and Trade of Caterpillar Mushroom and its Implication for Sustainable Management in Tibet Region of Southwest China

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Abstract

Caterpillar mushroom (*Ophiocordyceps sinensis*) has locally called Yartsa Gunbu, is a unique medical fungi which can be only found in alpine grassland in Himalaya mountain region, but had been widely used by Chinese for centuries. Along with commercial collection of caterpillar mushroom, it is crucial to understand local harvest and trade practice in order to generate the policy recommendation for improving the sustainable management. However, empirical grounded research and data is largely limited. This research provide the updating insight on caterpillar mushroom harvest and trade in the main production of Tibet Region of Southwest China. The robust quantitative data was collected from 2014-2015 by a questionnaire survey with local households (n=157) in six Tibetan communities from 2 counties and local traders (n=14) in the region. Quantitative data generated from 5 focus groups discussion with stakeholders and in-depth interviews in six communities. The research found the large difference of across region and community caterpillar mushroom harvest practice. The communities had involved in co-management scheme in Nature reserve practice better toward sustainable harvest than those who had not received external support and training. Moreover, customary tenure system effective act for caterpillar mushroom collection to avoid potential conflict and competition. However, majority of both counties practice similar in trade, which limited the possibility to improve local benefit generated from the commercial caterpillar mushroom harvest. Meanwhile, the local traders play a important role as bridge in the value chain and generate

great benefit from production classification. The policy implications draw from this research is that government should invest in training on harvest technique and market information dissemination for sustainable management. Also, it is critical that government recognize and support the customary tenure system of mushroom collection to avoid conflict and competition.

Key-words: *Ophiocordyceps sinensis*, commercial NTFP, medical plants, customary tenure value chain.

CMT-O 08

Crossing the Roofs of the World: The Nepal-China Trade in Commercial Medicinal Plants

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Abstract

Trade in medicinal plants between Nepal and China has taken place for centuries along the border in Tibet. The current booming of Chinese economics and increasing regional market integration has increased the volume and value of this trade in the recent past and it now supports the livelihood of millions of people in Nepal and China. Yet, nothing is known about the trade of Nepalese medicinal into the across Tibet, China. To fill the gap, the paper provides first qualitative insights of this cross-border trade. This paper adopted a value chain approach to examine the Nepal-China trade in medicinal plants. It tracks the flows of products from production sites in Nepal to regional wholesales in Tibet. Data was collected from December 2015 to August 2016 in Nepal and Tibet to map and understand the value chain, including the actors involved and key governance issues. The research found the medicinal plant trade boomed after 2011 when the value increased more than nine-fold reflecting a broader species composition and higher unit prices, both in response to increasing demand in China. Official records on both sides of the border under-document both the value and volume of trade implying that much of the trade is extra-legal. The value chain thus is governed by both legal and extra-legal mechanisms. While both states are taking efforts to

improve and formalize the trade, there is little empirical data and research to support policy formulation on sustainable trades. This study provides insights into the value chain and makes public policy recommendations to enhance transparent and sustainable trade by improving traditional border market and removing market barriers.

Key-words: NTFP, global value chain, Tibet, institutions, access, extra-legal.

CMT-O 09

Spatial and Seasonal Patterns in Extraction of Environmental Products

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Abstract

Environmental products provide an important source of income and basis for the livelihoods of rural people in developing countries. However, information about extraction patterns and the sustainability of extraction is usually limited. Therefore, as a basis for estimating the quantity of different products extracted and their spatial and seasonal distribution we conducted a survey around four communities in the lowlands, the middle hills and the high mountains of Nepal. Through group discussion, we identified main entry and exit points around each of the community managed forests. Subsequently we carried out measurements of products and interviews with collectors passing through the exit points over the course of a year (four cycles, 2012-2013). In each case, we asked the collector to identify the place of extraction among a set of previously mapped geographical units. In this paper, we present a preliminary analysis of the collection patterns observed, including the type of products collected, the spatial, seasonal and demographic distribution of the collection activity, the effort involved in collection, and the degree to which collection was done, either as an independent activity, or simultaneously with other activities, e.g. grazing the livestock.

Key-words: community forestry, non-timber forest products, sustainability, livelihoods, exit point survey.

CMT-O 10

**Collection and Utilization of Non-Timber Forest Products
from the High Hills of Nepal**

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Abstract

The Himalaya is believed to be a prime source of non-timber forest products (NTFPs) and, local people rely upon them as a source of livelihood, particularly for food, medicine and cash income. Understanding local people's dependency and their market value is imperative for its sustainable management in the face of changing environment. In line to this scenario, this study examined the collection, market potential, status and the factors affecting collection and trade of NTFPs in rural communities in Manang District of Nepal. Data were collected using structured schedule interview process which included information collected from key informants, Conservation Area Management Committee (CAMC) leaders and local NTFP traders. The findings revealed that 67% of households (HHs) collect NTFPs, which comprises 15 different types of NTFPs from forest. Most (56%) of the HHs collect NTFPs for food purpose and few (22%) of them sell for economic return. The result indicated that economically poor HHs were significantly involved in the trade of NTFPs. Increasing walking distance to resource significantly represents strong willingness towards NTFPs trading activities. High value commercial NTFPs are decreasing at an alarming rate due to the tradeoff between exploitation and conservation of resources. Commercialization of these potentially high value NTFPs may improve this scenario by addressing the livelihood options, however understanding market value chain is most.

Key-words: Himalayas, poverty, NTFPs, livelihood, income.

CMT-O 11

**Value Chain of *Acacia catechu* from Syangja District
of Western Nepal**

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Abstract

Acacia catechu is one of the highly valuable tree species of Nepal with significant potentiality to contribute to local and national economies and ecological benefits. Kattha and cutch produced from its heartwood have higher commercial importance. The study applied the theory of access and value chain governance to examine the value chain of *A. catechu* with the objectives of identifying chain actors, their functions and interactions; estimating cost and value-added distribution; and attempted to identify mechanisms of access to benefits and value chain governance. Using snowball sampling method, the study was carried out from Syangja district and was followed upto Kattha industry. The study found producers, village traders, intermediary traders and industries as the main actors at the domestic level. Very limited primary processing takes place at the local level and major proportion of value addition lies at the industry level. The trade of *A. catechu* products is financially profitable for all the actors in the chain. However, benefits are unequally distributed and commercialization margin is increasingly distributed towards the downstream actors. Access to finance, market information and relationship buildings are the main means of controlling and maintaining access. Apart from legal rights, there exist other extra-legal forces through which various other actors grip benefits. The prevalence of captive type of value chain governance together with extra-legal forces creates imperfect market structure. Proper policy, provision of basic market infrastructures, empowerment of the producers and promotional management of resource base are suggested for its sustainability.

Key words: value chain, snowball, access, commercialization margin, governance.

CMT-O 12

**Marketing scenario of Major Medicinal and Aromatic Plants
in Tinejure-Milke-Jaljale Protection Forest in Nepal**

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Abstract

The Tinejure Milke Jaljale (TMJ) area is rich in high-value medicinal and aromatic plants (MAPs). Such MAPs are identified as one of the potential high value commodities. The present study was carried out to find the major species, their marketing scenario, and constraints and opportunities of major MAPs in TMJ area. PRA tools were carried out to collect information. The study showed that the major MAPs traded from the area were *Swertia chirayita*, *Rubia manjith*, *Lycopodium clavatum*, *Paris polyphylla*, *Trichosanthes tricuspidata* and *Aconitum spicatum*. Out of these species, 60% trade was covered by *Swertia chirayita* and 35% by *Rubia manjith*. Jirikhimti and Basantpur Bazar were found to be the major hubs of MAP trade. Over 90% of MAPs are transited to the border of eastern Nepal, India and western countries from Basantpur market. About 57%, 17% and 26% MAPs were collected from government managed forest, community forest, and private forest, respectively. In total, 35301 kg of major MAPs were traded with a total annual earning of USD 34608. Market monopoly, unaware of proper harvesting technique, lack of market information and lack of value addition techniques at the local producers and traders levels were identified as major constraints in MAP sector in TMJ area. There is a need to support local harvesters and traders by developing proper market information system and networks, and encourage them to apply value additional activities at local level.

Key-words: marketing network, commodities, value addition, MAPs.

CMT-O 13

Assessment on Market Opportunities for Integrated Pest Management Grown Produce in Rupandehi and Nawalparasi Districts

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Abstract

This study entitled "An assessment of marketing opportunities of IPM grown produce in Rupandehi and Nawalparasi districts was conducted from 12th January to 20th May 2015. A total of 330 respondents were randomly selected for survey from those two, districts out of which 100 consumers, 50 farmers, 10 traders, 5 agrovets were selected from each districts. In both districts, most of the farmers were from age group of 41 to 50 years and had land holding of 3 to 6 hectares. Farmers produced different high value vegetables adopting IPM approach. Due to awareness about effect of chemical pesticides consumers were found using remedial measures like deep freezing and proper washing before consumption. Consumers of both districts preferred IPM vegetables where forty five percent consumers bought vegetables in local market and forty percent consumers were found using haatbajar which indicate good marketing opportunities for IPM vegetables of local level. Moreover fifty-nine percent traders of both districts showed willingness to sell IPM produce to meet demand in market. But there was not enough production of IPM produce for regular supply to market. There is lack of certification procedure and quality assuring label at point of sale that did not assure consumers assured quality of product. Sixty-eight percent farmers revealed that price of IPM produce was fixed by the unilaterally traders. The study revealed that on an average B/C ratio of IPM product per hectare was 1.54. IPM products have good marketing potential in both districts.

Key-words: integrated pest management, farmers, traders, consumers.

CMT-O 14

Green Growth in Nepal's Medicinal and Aromatic Plant Sector: Methods and Data

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Abstract

Nepal's medicinal and aromatic plant (MAP) sector involves millions of people and has the potential to promote pro-poor employment and earnings as well as sustainable resource use. However, lack of empirically-based knowledge on production networks for MAPs traded in and from Nepal to India and China impedes the identification of points of intervention that can promote sustainable resource use, generate employment in the sector, contribute to poverty alleviation and ultimately also to green growth in Nepal. The *Transiting to Green Growth in Nepal* (TGG-N) project which started in January 2014 has generated data through transnational production network actor interviews, from harvesters through traders in India and China and regulatory bodies, as well as ecological inventories. The aim of this session is to share an overview of the applied methods used and data collected by the TGG-N project members. This encompasses national-level trade data, processor survey data, consumer survey data, domestication and wild collection livelihoods data, ecological data as well as data on the political ecology of the MAP sector in Nepal.

Key-words: MAP, trade, global production networks, income, livelihood, conservation.

CMT-O 15

**At the Margin: Local Traders in Transnational Production
Networks for Medicinal Plants**

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Abstract

A transnational production network (TPN) is the transnationally organized nexus of interconnected functions and transactions by firms and non-firm institutions through which a specific product is produced, distributed and consumed. The TPN framework is conceptually rich but empirically underdeveloped, in particular for TPNs based on agricultural products. This paper deals with the local traders of medicinal plant in the Far-Western Development Region (FWDR) of Nepal, the ‘tentacles at origin’ of the export flows from Nepal to India and China. The analysis focuses on different types of network configurations and power relations between the actors involved. Particular attention is devoted to relational proximity, i.e. the role of trust in the commercial linkages. Data is derived from interviews with harvesters, traders, and wholesalers conducted in the FWDR in autumn 2015 and spring 2016. Data was transcribed, translated, coded, and qualitatively analyzed. The different types of trading relationships are identified and their distinct characteristics originating from the ‘nature’ of the particular medicinal plant (price, volume, wild/domesticated, etc.), entry barriers, value-creating activities and up-grading strategies are outlined. The findings indicate that despite a string of local and regional monopsonies, some local traders are strengthening their position in the TPN due to their control over the sourcing of medicinal plants and the relatively recent phenomenon of transparent buying prices offered by wholesalers.

Key-words: Medicinal plants, trade networks, trust, Nepal.

CMT-O 16

**Wild Collection of Lemon Grass for Essential Oil
Production in Eastern Nepal and Export to the EU**

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Abstract

The market for essential oils in the UK and Europe as a whole is now a substantial one and growing at a rapid rate. Much of this is imported and the trend for imports is growing. This study shows how a developing country like Nepal can capitalize on this lucrative market whilst at the same time benefiting the stakeholders by guaranteeing them a larger share of the margin through fair-wild labelling. By so doing the outcome is to offer relevant and sustainable development support to the producer organization. Some inevitable risks and uncertainties have been highlighted but the financial projections show a healthy profit is available as a result of this activity.

Key-words: fair-wild certification, essential oils extraction, export.

CMT-O 17

**Non-timber Forest Products: Collection and Trade Scenario
in Makawanpur District, Central Nepal**

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Abstract

Non-timber forest products (NTFPs) are those biological materials other than timber derived from forest. This paper aims to explore status of collection and trade scenario of NTFPs and its role in enhancing livelihood of locals in Makawanpur district, Nepal. Field visit, door to door surveys and group discussion with traditional users based on semi-structured questionnaires were conducted to collect data regarding status of NTFPs while total volume and revenue of traded species were listed using data published by government body. Out of 197 species of NTFPs present in Makawanpur, about 25 species were exclusively collected and traded. Among them, 7 species were famous to extract fruit followed by 6 species for bark. However, few species including *Swertia chirayita* were uprooted as a whole plant. NTFPs were mainly harvested from Lothar, Manahari, Bastipur, Kogate, Ipa, Tistung, Daman, Palung, Sisneri, Shikharpur, Phaparbari, Sannanitar and Chaughada. Collected materials were traded to India through Hetauda and Birgunj just following a simple value addition. A total of 139,500 kg of NTFPs was traded from Makawanpur district, generating revenue of NRs. 86,656 in the last fiscal year (2073/074). Based on volume, *Asparagus racemosus* occupied the first position in trade (with total contribution of 97,435 kg), followed by *Myrsine semiserrata* and *Oroxylum indicum*.

Key-words: NTFP, Hetauda, trade, value addition, livelihood.

CMT-O 18

Trade of Medicinal and Aromatic Plants from Periodic Markets in the Central Himalayan Lowlands

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Abstract

Information on the periodic medicinal and aromatic plant markets in Nepal is non-existent. This study investigates the structure and functions of periodic markets of Morang District and the economic importance of the retail trade of unprocessed medicinal plants from these markets. Data were collected from 55 periodic markets through medicinal plant retailer interviews ($n = 57$), observation of market characteristics and functions ($n = 55$), and daily transactions of medicinal plants offered for sale at individual medicinal plant stall ($n = 9$). Emphasis was on developing a market and a retailer typology and on quantifying the volume and value of the medicinal plants trade. The study identified three types of markets and two types of retailers which are further divided into four sub-types and eight specific types. The study documented the trade of 58 medicinal plant species from 28 periodic markets. The annual trade is estimated to be 30 tones with a value of USD PPP 0.48 million accounting for 10% of the total district trade export amount. The retail trade generated 1.26 times higher value than the district level harvester trade value while constituting 84% of the district level wholesale trade value. The study concludes that the retail trade is of substantial economic importance. Traditional spiritual belief is a key driver behind medicinal plants trade. Therefore, the demand of medicinal plants is likely to remain buoyant in the future. The study highlights the need to recognize the role of local markets and the domestic MAPs trade to the local and national economy and to focus future governmental interventions on making appropriate market development and medicinal plant trade policies.

Collection, Marketing and Trade (Poster Session)

CMT-P 01

Harvesting, Use and Value Change Dynamics of Yarsagumba in Nepal

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Abstract

Yarsagumba '*Cordyceps sinensis*' is one of the high value medicinal fungi. It is mostly available in central and western Himalayan regions of the country. The interest of different stakeholders on Yarsagumba has been massively growing in these days in Nepal as its economic and social value has taken its maximum height. In this context this review paper aims to portrait the harvesting process, uses and the value chain dynamics in Nepal to help aware the stakeholders on its sustainable management and to create conducive benefit sharing mechanisms. The paper is particularly based on the review of literature from 1990 to 2015 focusing on the cases in Nepal. In additional it reflects the knowledge of the researcher working for last 20 years in this field. The study reveals that despite having the high economic and social value Yarsagumba have been facing several challenges during its harvesting period particularly due to the early and improper harvesting activities dominated by destruction of its natural habitat. Yarsagumba has long history on its use with multiple healing capacities and medicinal uses. Regardless of involvement of many stakeholders in its marketing, the value addition of this medicinal plant is facing problem with more focus on its collection and direct trade without any value addition techniques. The study argues that the sustainable management of Yarsagumba has been facing problem particularly on its harvesting activities. In addition it needs the clear policy on its marketing and value addition process.

CMT- P 02

Patterns of Change: The Dynamics of Medicinal Plant Trade in the Central Himalayas

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Abstract

Quantitative environmental product trade studies, undertaken in the same location over time, provide inputs to understanding rural development and biodiversity conservation issues. The current study investigates change in medicinal plant trade in the past 17 years and identify the main factors driving changes, using a study of Darchula District in far-western Nepal. Medicinal plant production network data were collected from March to August 2016, for the fiscal year 2014-15 through 154 quantitative (58 harvesters, 38 sub-local traders, 25 local traders, 17 central wholesalers, and 16 regional wholesalers), 67 qualitative (15 sub-local traders, 19 local traders, 17 central wholesalers, and 16 regional wholesalers) and four focus group discussions. Results were compared to previously unpublished similar data for Darchula District for the year 1997-98, using quantitative and qualitative interviews with 10 local traders, 20 central wholesalers, and 53 regional wholesalers. Data was analysed using an analytical framework focused on understanding changes in the medicinal plant trade, derived from Global Production Network theory. Quantitative data were used to estimate changes in eleven indicators while the qualitative information allowed identification the factors driving the observed changes. The annual volume of medicinal plants traded from Darchula district was 401 tons with local traders' value of USD 5.5 million in the fiscal year 2014-15, representing a 2.3 fold increase in volume and 16.3 fold increase in value compared to 1997-98. The trade comprised 23 air-dried plant products (from 24 identified species); 12 products were traded in both

periods, while seven disappeared, and 12 new products entered the trade. These changes are caused by new product demands and higher prices associated with rising incomes in China, the establishment of domestication and cultivation at lower altitudes, expanding infrastructure (roads and communications), and the establishment of processor industries in Nepal eroding the previous central wholesaler oligopsony. In addition, it appears that collection of the very high valued *Ophiocordyceps sinensis* has indirect conservation benefits as it lessens harvester focus on other species. Regional economic development has increased the trade in medicinal plant products from far-western Nepal in the past two decades. There is no reason to believe this development will change in the near or medium term. Hence commercial medicinal plant resources in far-western Nepal constitute a substantial asset that can promote economic development to the advantage of rural harvesters. Attention should also be paid to issues of conservation as different products enter and leave markets.

Key words: non-timber forest products, herbal market, globalization, margins, livelihoods, global production network, Nepal.

CMT-P 03

Untapped Potentiality of NTFP in Nepal: A Case Study from three Districts of Dhaulagiri

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Abstract

Non-timber forest products (NTFPs) of Nepal have potentiality to contribute to the local and national economy. Studies showed that full potentiality of NTFPs has not been realized yet. This paper aims to explore how much the NTFP resources are extracted from the government managed forests of Nepal. As a case study we collect data from three districts of Dhaulagiri *viz.* Baglung, Parbat and Myagdi. Data of NTFPs extraction in fiscal year 2016/017 were collected from District Forest Offices and compared them with the Annual Allowable Harvest (AAH) specified in the five year forest management plan. In the management plan, AAH of 57 species in Baglung, 50 species in Myagdi and 13 species in Parbat districts are specified. Only 20 species from Baglung, 16 species from Myagdi and none species from Parbat were harvested in fiscal year 2016/017. Annual allowable harvest of the NTFPs in these three districts is 454206 kg/year with a potentiality of collecting NRs. 7850040 royalty annually. The extracted amount of NTFPs is only 31188.7 kg/year and revenue is NRs. 461477.5. The amount of extracted NTFP is 9.59% and 3.64% in Baglung and Myagdi districts respectively while Parbat has no extraction of NTFPs from national forests. Discussion with district forest officers revealed that inadequate amount of NTFPs for commercial harvesting and lack of separate NTFP development and utilization plan are the major causes behind this underutilization. Formulating separate NTFP collection and development plan is recommended.

Key-words: allowable harvest, extraction, management, potentiality.

CMT-P 04

Kutki in Consumer Products in Nepal - A Market and Industry Survey

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Abstract

Rhizomes of *Neopicrorhiza scrophulariiflora* and *Picrorhiza kurrooa* (hereafter *kutki* as common trade name) have medicinal properties. High levels of trade of *kutki* rhizome exist in Nepal, India and China. What drives demand of *kutki* in Nepal is unknown. In this context, market and industry involved in its processing were surveyed during September 2016 to March 2017 to identify industries, their consumer products, product-wise demand of raw *kutki*, uses of these products and also to estimate annual industrial demand. We observed 2313 herbal products for *kutki* in 38 retailer shops, noted manufacturers of these products and their main uses at Kathmandu (30) and Bharatpur (8) cities. Further, industries, located in 8 districts of Nepal, involved in the processing of *kutki* were visited. Interviews were conducted with the representatives of these industries using structured questionnaire. Twenty two industries in Nepal were found processing *kutki* to manufacture 44 consumer products: Ayurvedic medicines (42), tea (1) and toothpaste (1) in 2016/17. The total consumption of dry *kutki* rhizomes by these industries was 5650 kg, with an average volume of 257 kg per industry. These consumer products containing *kutki* were mentioned as useful for treatment of health disorders associated with liver (17), blood (5), immune system (5), stomach (5), skin (4), joint (2), lungs (2), fever (1), tooth (1), urinary system (1) and body mass (1). The consumption of consumer products containing *kutki* should be further explored.

Theme 2: Conservation and Sustainable Use

(Oral presentation)

CSU-O 01

**People's Awareness and Practice of Forest
Certification in Community Forestry
(A Case Study from Bajhang District)**

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Abstract

In Nepal, forest certification is emerging stage and moved the topic on the national agenda in interim plan 2007-2010. The study was carried to understand implementing status of FSC principle in certified CFUG using participatory rural appraisal tools. Overall, awareness of the CFUG in forest certification is in middle level. They have high knowledge on traditional issues and relatively low in new issues. Certification mainly for NTFPs promotion within short time period is the most effectual cause of insufficient awareness. It is also due to some demographic features of the users. Similarly, knowledge on program, demographic feature of user and benefits gained from the program are major causes to be satisfied with the program. Most of the people are satisfied and their attitude is all most all positive towards forest certification. Over all status of present management practices in community forestry is good. Although, most of traditional management activities (protection, operation, utilization) are implemented in better way and application of new technologies/issues required by forest certification is poor in community forestry. The major causes of incomplete implementation of FSC principles are lack of sufficient knowledge, lack of skilled man power and lack of fund. Sufficient fund mobilization for the trainings/workshops and extension program is crucial to improve present management status of forest. Conducting forest certification training will be helpful to raise awareness about new issues required by FSC principles. Operational plan and constitute should be revised formulating local standards of FSC principles and endorsing those with effective plan.

Key-words: FSC Principles, Implementation, knowledge, attitude.

CSU-O 02

**Implementation of Fair Wild Standard Best Practice:
Human and Conservation Benefits through
Sustainable Trade in Wild Plants in Asia**

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Abstract

Wild plants are used in products consumed daily around the world, often as ‘hidden ingredients’ that consumers and companies are unaware of due to the complexity of trade chains. This trade contributes to the livelihoods of millions of people, in particular in Asia, but many of the plant species used are under pressure from unsustainable harvesting and all too often the economic benefits are inequitably shared. Best practices for verifying wild collection sustainability are available, for example the FairWild Standard. Its implementation as a certification scheme in India and Kazakhstan among others, as the best practice by industry (e.g. with the traditional medicine manufacturers and traders in China), in support of better community resource management in Viet Nam, and for policy frameworks by governments provide lessons learnt around the impacts of this work on trade chains. Case-studies on the practical livelihoods and conservation benefits from the Fair Wild implementation can be highlighted, including of *Terminalia spp.* harvesting in Western Ghats of India, *Gynostemma pentaphyllum* collection from the Bac Kan province of Viet Nam. Looking into the future, a number of interventions are required to have an impact on the number of species and volume of wild-collected material in trade from and within Asia. These include a combination of increased incentives and pathways for businesses, communities and consumers to engage in responsible trade.

Key-words: sustainable wild-harvesting, equitable trade, livelihoods, FairWild, certification.

CSU-O 03

Community Perception on the Impacts of Invasive Alien Plants in Chitwan-Annapurna Landscape, Nepal

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Abstract

Active participation of community is essential for the management of invasive alien plant species (IAPS). Understanding the level of community awareness and their perception on the impacts of IAPS is crucial for improving community participation in the IAPS management. We conducted 31 Focused Group Discussions (FGD) in Chitwan-Annapurna Landscape of Nepal to 1) identify most problematic IAPS and their impacts in agro-ecosystems and natural vegetations; and 2) assess effort of communities, if any, to manage IAPS. Altogether 207 local people, mostly the executive members of the Community Forest Users' Group, participated in the FGDs. Communities were not aware of the origin and nature of IAPS but they clearly had living memory of the arrival of some of the IAPS in their locality. They could document most of the IAPS and prioritize based on their negative impacts. *Ageratum houstonianum* was reported as the most problematic in agro-ecosystems by 21 FGDs while the remaining FGDs reported *Oxalis latifolia*, *Bidens pilosa*, *Galinsoga quadriradiata*, *Pistia stratiotes*, *Xanthium strumarium* and *Parthenium hysterophorus*. In forest and other natural ecosystems, *Chromolaena odorata* and *Ageratina adenophora* were reported as the most problematic by 12 and 10 FGDs, respectively, while others reported *Mikania micrantha*, *Parthenium hysterophorus* and *Lantana camara*.

Theme 2: Conservation and Sustainable Use

The major impacts perceived by the local communities included increase in labor input for weeding in agroecosystems, and reduced tree regeneration and decline in forage supply from forest and other natural ecosystem. Community participation in IAPS management was very low and limited only to cultural method such as biomass utilization at a few locations. Community education and provision of technical support in IAPS management planning can improve community participation.

Key-words: agroecosystem, focused group discussion, forest and rangeland, forest users' group, species prioritization.

CSU-O 04

Facilitators' Role on Sustainable Forest Management: Experiences of COFSUN, Nepal

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Abstract

Guideline of community forestry development program in Nepal is prepared to promote and strengthen community forestry in Nepal. Active engagement of the right holders of community forestry sector and stakeholder organizations during the development process was the key factor that developed the sense of ownership to all. Despite the stakeholders' ownership on this key document of CF, implementation of the guidelines for the sustainable forest management was taken a bit challenging due to the limited human resources and capacity of the officials under Ministry of Forests and Soil Conservation. With this challenge COFSUN, a network of community based forestry facilitators started capacitating its network members and mobilizing them to facilitate CFUGs to implement the guidelines. Development of curriculum targeting to the field facilitators and providing them the long term and short term trainings on the subject matter with an accreditation from the government authorized agency CTEVT. Facilitators are playing key role in implementing the guideline primarily to improve governance and this effort has achieved important progress in sustainable forest management and enterprise development. Key impacts of the effort include the increased trend of allocation of 35 percent amount of CF fund for the development program of poor, institutionalization of public hearing and public auditing in CFUG and improved inclusion of women and social group in the committee.

Key-words: community forestry development program guideline, governance.

CSU-O 05

An Assessment of Biomass and Carbon Stock in Tropical Natural Forest of Nepal

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Abstract

Forest plays an important role in the global carbon cycle balance. As both carbon sources and sinks, they have the potential to form an important components in efforts to combat global climate change. So, research entitled “An Assessment of Biomass and Carbon Stock in Tropical Natural Forest of Nepal was focused to quantify above and below ground tree biomass and carbon stock in moderately sparse urban natural forest in Institute of Forestry, Hetauda. Twenty four sample plots (based on statistical data with 1% sampling intensity) were established within study area. Circular plots of radius 12.62m were established to measure forest biomass in stratified forest. For the purpose of this study, woody plants with ≥ 5 cm DBH were taken to calculate biomass and carbon stock. The total forest cover area is found to be 81.88 ha. T test shows that biomass and carbon stock in the different strata of forest are significantly different. The total biomass of the tree in the forest of Institute of Forestry, Hetauda Campus is found to be 483.49t /ha (i.e. 44655 t). Similarly carbon stock in the forest is found to be 207.4 t/ha (i.e.19155.7 t). The biomass and carbon Stock in the forest of *Shorea robusta* was found more than two times i.e. 213% greater than that of in mixed forest within Institute of Forestry forest area.

Key-words: carbon stock, tree biomass, natural forest, IOF.

CSU-O 06

A Hidden Reality: Use of the Community Forest Management Plans in Nepal

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Abstract

Community forest user groups' exclusive rights and access to forests are contingent on a management plan endorsed by the concerned district forest office. However, the extent to which these plans are in fact used to steer forest management interventions is unclear. This paper documents how such plans are (not) implemented in the community forests while serving unofficial objectives of the forest bureaucracy. The study is based on intensive field observations in six community forests over a period of two years along with content analyses of the plans and consultations with executive committee members, forest users, and district forest officials. The results revealed that communities hardly comply with any of their plans' institutional, technical, and financial aspects. The plans were simply bureaucratic documents required for harvesting and marketing forest products. Accordingly, other realities than the management plans appear to steer silvicultural interventions which put into question the very usefulness and need of such plans. Sometimes these realities 'save' the forests from devastation but the harvest is overly restricted. However, the plans do serve to generate official and unofficial funds to the forest bureaucracy, which also use them to increase its control over community forests which is entirely against the spirit if not the letter of Nepal's community forestry policy and legislation, especially the 1993 Forest Act and the 1995 Forest Regulation.

Key-words: plan, bureaucracy, compliance, control, harvesting.

CSU-O 07

Consequence of Forest Decade Program on Private Forest Registration and Timber Harvesting from Private Land: Case Study from Dang and Banke District

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Abstract

Government of Nepal declared ‘Forest Decade Year’ from 2071 to 2080 to achieve the objective of newly adopted forest policy 2071 - forestry for prosperity. One of the objectives of the program is to revitalize the private forest through providing incentives to the forest owners. This study aims to examine the consequences of forest decade program on private forest registration and timber harvesting from private land. Banke and Dang districts were selected for the study. Primary data were collected through personal interviews, key informant interview, focus group discussion, workshop, and field observation. Similarly, secondary data were collected from District Forest Offices and other related official reports and records, and reviewing the existing laws and policies. Qualitative and quantitative tools were used to analyze the data. The results showed that private forest registration process began in Banke from the fiscal year 2053/2054 and in Dang from the year 2043/2044. In both districts, there was increasing trend of private forest registration till 2055 thereafter decreased to zero in the year 2059/2060 and again revived from 2071/2072 after adopting forest decade program. After forest decade program, big farmers’ attraction in private forest registration was observed in both districts, but the production of timber from private land was decreased. Women ownership in private forest was high in Dang than in Banke. From the last five years, there is changing demand to choose the species for private plantation.

Key-words: private forest, forest decade, registration, farmer, timber demand.

CSU-O 08

Variation in Life History Traits of a Threatened Medicinal Orchid *Dactylorhiza hatagirea* (D. Don) Soó along an Environmental Gradient in Nepal Himalaya

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Abstract

Dactylorhiza hatagirea (D. Don) Soó is a medicinal orchid occurring in the high Himalayan region ranging at elevation from 3000 to 4600 m asl. The species is highly threatened due to illegal trade and habitat loss. Development of a strategic plan for sustainable management of this species is urgently needed. A long-term study was thus carried out to assess the effects of disturbance on the life history traits of the species along an ecological gradient. A highly disturbed (open for illegal harvesting and livestock grazing) site in NW Nepal and a relatively undisturbed (community protected) site in C Nepal were selected. In each site, three populations were studied along an elevation gradient ranging from 3600 to 4600 m. Plant density was found significantly higher in the undisturbed than in disturbed site but the variability of plant density among the populations within site was less pronounced. Higher reproductive performance was observed in populations subjected to low levels of disturbance. The present study indicates that the reproductive performance of *D. hatagirea* populations is highly sensitive to harvesting and browsing. The sensitivity, however, varies among habitats and along the elevation gradient. The results of the present study indicate that the sustainability of *D. hatagirea* populations largely depends on controlling illegal and premature harvesting of tubers to ensure completion of asexual and sexual reproduction and the dispersal of viable seeds.

Key-words: Anthropogenic factors, threatened, population density, sustainability.

CSU-O 09

Estimating Ecosystem Services Using Geospatial Approach at Landscape Level

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Abstract

Landscape is the set of area with the major functions of the systems and ecosystems occur at the large areas. The segregated and differentiated function are more integrated form at landscape level which basically at the ecosystem level. Landscape thus has the complex functions of ecology as an integrated form of the activity specific, site specific and species specific functions. Thus the ecosystem has various services provided to the ecology, natural resources and society considering the larger area and integral approach. Continuous Vegetation, Net primary productivity, land cover, evapo-transpiration, surface temperature. Specifically forest ecosystem has greater role on the system balance of the natural phenomenon at macro level by water recharge, forest products, carbon sequestration, forest health and greenery, soil conservation, biodiversity conservation. The study aims to use the remote sensing based products and the field level information generated to assess the ecosystem services provided from the forest ecosystem in CHAL Landscape. The remote sensing products from MODIS, spatial base data and the field generated data has been integrated to see the services from the forest ecosystem in the landscape. The result shows the spatial variability of the ecosystem services depends on the availability of the forest resources, climatic condition specifically rainfall and temperature of the particular areas and the people -forest interactions.

Key-words: Chitwan Annapurna Landscape (CHAL), GIS, MODIS, remote sensing, ecological functions.

CSU-O 10

Some Wild Mushrooms of Udayapur District, East Nepal

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Abstract

This mycological investigation was carried out in natural as well as community managed forests of Udayapur District of Nepal. Samples were collected in the year 2017 in areas ranging in elevation between 360 and 1500 m asl and representing tropical deciduous riverine forest to subtropical deciduous hill forest. This paper highlights ethnomycological significance of *Agaricus xanthodermis*, *A. sylvicola*, *Amanita pantheriana*, *Armellia mella*, *Boletus radicans*, *Bovista plumbia*, *Dictyophora indusiata*, *Russula foetens* and *Scleroderma oriantium*. These mushrooms have edible and therapeutic values. The collected samples represented nine species of Basidiomycetes belonging to five orders and nine families.

Key-words: macro-fungi, sustainable use, taxonomy, topography.

CSU-O 11

PPBio Nepal: Long-Term Ecological Research and Biodiversity Monitoring

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Abstract

Developing a sustainable system for long-term ecological research and monitoring (LTERM) biodiversity and ecosystems is one of the greatest ecological challenges of the new millennium. To date long-term monitoring has been executed by individual scientists with a long-term vision. The PPBio Nepal project was initiated in Chitwan National Park in 2007 as a collaboration between Tribhuvan University, DNPWC, Griffith University in Australia. Permanent plots were established and biodiversity surveys completed each year. The PPBio LTERM system was developed to support those scientists with a track record for answering “important ecological questions”, and provide data that is suitable for government agencies responsible for the environment. I will discuss the benefits of developing a sustainable (~4,000 year) LTERM system that provides both a powerful platform for scientists to answer important ecological research questions, and standardized systematic data that is useful for government agencies responsible for monitoring biodiversity and ecosystem health.

Key-words: biodiversity, monitoring, climate change, ecology.

CSU-O 12

Quantification of Bioactive Marker Compounds in the Accessions of *Picrorhiza kurrooa* Grown in Nepal

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Abstract

Picrorhiza kurrooa Royle ex Benth. (Family Scrophulariaceae) is a medicinally revered herb and grows in the Himalayan region. Its rhizomes are used extensively in traditional medicinal systems. As a consequence of over harvesting of wild stock and shortage of natural populations, *P. kurrooa* is listed as a threatened medicinal plant species. Picoside-I and kutkoside are the bioactive marker metabolites of *P. kurrooa*. Thirty-six accessions of *P. kurrooa* from different altitudes (3170 to 4414m) in Far- and Mid-Western Development Region of Nepal were screened for bioactive marker. The rhizomes were shade dried, milled, defatted, and extracted with hot methanol. The extracts for picoside-I and kutkoside content were analyzed by HPTLC method validated for linearity, precision, specificity and accuracy according to ICH, 1995 guidelines. Separation and quantification of picoside-I R_f (0.55) and kutkoside R_f (0.41) was achieved on precoated silica gel 60F₂₅₄ aluminium plates using mobile phase chloroform-methanol (75:25, v/v) in a twin trough chamber saturated for 20 minutes. Kutkin content was observed to vary with the altitude. Picoside-I, kutkoside and kutkin ranged 0.77 to 4.88%; 0.52 to 8.91% and 2.10 to 11.37% respectively. ANOVA analysis revealed significant variation in the content of kutkoside and kutkin with altitude. However, no significant variation in picoside-I with the altitude was found. Six chemically superior accessions of *P. kurrooa* containing high kutkin content were identified for their conservation and cultivation.

Key-words: HPTLC, *Picrorhiza kurrooa*, Picoside-I, and Kutkoside.

CSU-O 13

**Effectiveness of Tree Plantation Program
in Chure and Terai Region of Nepal**

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Abstract

Afforestation and reforestation program was started in 1970's to restore the denuded hills in Nepal. Low survival rate of trees planted in such area is common. There is a need to understand the cause of low success of such plantation and propose adequate solutions to improve tree survival rate. This study has covered five districts (Chitwan, Makwanpur, Bara, Parsa and Rautahat) in central Nepal. Direct observation of nurseries, interviews, key informants survey and inventory of the plantation forest were major methods applied for the study. Present study reveals that average of 344,000 seedlings were being produced per districts per year from the year 2005 to 2015 and the seedling production has been increasing in recent year. In the year 2016/17, only the Rautahat district has produced more than 1.2 million seedlings. However, plantation plan was not observed in any of the districts. The seed source was also not reliable as there was no any reliable seed supplier or seed orchards in the region. Most of the planting materials were single year seedlings and due to lack of hardening off of the seedlings to tolerate the adverse climatic condition, higher percentage of mortality (about 72%) was observed during the dry season of next consecutive years. Low quality of seedlings, grazing pressure and improper selection of species for specific site quality were identified major limiting factor for the success of plantation program in the region. Detail plantation plan has been recommended prior to the production of seedlings in the nurseries. At least one permanent nursery for each district has to be established so that seedlings could be provided for plantation in pre-monsoon of next consecutive year that has the better growth performance in the region.

Key-words: hardening off, plantation, seedlings, survival.

CSU-O 14

Restoration and Recolonization of Native Threatened Tree Species in Chittagong University Campus, Bangladesh

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Abstract

The forests of Bangladesh are considered as one of the richest and biologically diverse forest resources in this region. But, the natural forests are declining at an alarming rate due to population pressure, heavy dependence on fuelwood, timber and other products, clearing land for agriculture, shifting cultivation, and encroachment, overexploitation of the resources and conversion of forests land to other uses. The issues of conservation and protection of biological diversity are gaining momentum and the necessity to conserve natural forest resources is now widely appreciated by different organizations, Forest Department and the Government. Arannayk Foundation – a Tropical Forest Conservation Program of both the Government of Bangladesh and the USA initiates a program of restoration and recolonization of threatened native tree species of Bangladesh with the collaboration of Institute of Forestry and Environmental Sciences of Chittagong University (IFESCU), Bangladesh. Fruits and seeds of all 60 threatened native tree species were collected from the remnant natural sal and hill forests; raise seedlings, and establish seed stands during 2011-2015 in an aim to restore and recolonize the threatened native tree species in the university campus. The present paper briefly discusses the status of 60 native tree species used for *ex situ* conservation programs in Chittagong University campus, Bangladesh.

CSU-O 15

**Exploring Community-Based Natural Waterhole
Conservation Initiatives in Lamjung District, Nepal**

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Abstract

This study analyzed the status and distribution of natural waterholes and their conservation initiatives taken by the local community at Ishaneswor Village Development Committee (VDC) of Lamjung District, Nepal. Data were collected using reconnaissance survey, village level meetings, semi structured interview, satellite image analysis and GPS survey. Rainfall and temperature trend of the area between the periods 1985 to 2015 was also analyzed. Results reveal that out of the twelve natural waterholes found in the VDC, two of them were dried up due to landslide and flooding, and other two dried up due to road construction and encroachment. The remaining eight were also found in vulnerable condition due to several reasons; landslide, soil erosion, road construction earthquake and draught. In 2015, local community restored two of the waterholes by digging and constructing well. Geo-spatial analysis showed that over the last 25 years, forest area in the VDC increased by 0.26% per annum while water body has decreased by 2.9%. This is also validated by the response of majority of local people who state that the number of waterhole and availability of water resources were seen in a decreasing trend since last 10 year. Local people are using indigenous knowledge and techniques such as construction of stone walls, plantation work, conservation of water pipe, cleaning around waterhole, well digging etc for conserving water resources and waterholes. The study suggests the urgent need of supporting the initiatives taken by the community by launching some specific program for the conservation of waterhole in the area.

Key-words: local community, water resources, natural disaster, geo-spatial analysis, Nepal.

CSU-O 16

**Exploration of Orchid Diversity and Conservation
Status in Selected Community Forests of
Makawanpur District, Central Nepal**

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Abstract

Orchidaceae is one of the largest and most diverse families of flowering plants, comprising above 450 species that span 107 genera in Nepal. Since the orchids are facing pressure of various anthropogenic factors at local, regional, national, and global level, we attempted to explore the diversity of orchids in two community managed forests – Karunabhumi community forest at Daman and Chandragiri community forest at Chitlang of Makawanpur district, Central Nepal. With the introduction of community forestry program in Nepal, some progress are happening in conserving the habitats of orchids, which has minimized the unsystematic and illegal collection of orchids, and cutting and falling down of trees which are the habitat for epiphytic species. We compiled 58 species of orchids from 23 genera including 47 epiphytic and 11 terrestrial with 29 species having medicinal uses. Out of 58 recorded species, *Gastrochilus calceolaris* recorded as Critically Endangered (CR) and *Bulbophyllum leopardinum* and *Spiranthes sinensis* as Least Concern (LC) species belonged to category of IUCN. In our study the local people were also involved in the exploration, thus the stakeholders realized the necessity of conservation of orchids, an important component of biodiversity.

Key-words: community forests, conservation, diversity, orchids.

CSU-O 17

Effects of Environmental Factors along a Harvest Gradient on Density and Biomass of a Clonal Medicinal Herb, *Neopicrorhiza Scrophulariiflora* in Alpine Himalaya, Nepal

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Abstract

Understanding the interaction between clonal plants, human disturbance and surrounding vegetation in alpine environment is an important area of ecological research. Anthropogenic disturbance, such as harvesting may have negative impacts on population of clonal plants, but nutrient accumulation through microbial activity, shade and moisture retention offered by surrounding vegetation, and accumulation of plant litter could reduce negative anthropogenic impacts. We studied density and biomass variation of a threatened clonal herb, *Neopicrorhiza scrophulariiflora* to understand the population performance across a continuum of environmental conditions and harvest impacts. The study was carried out at two sites in alpine Himalaya, one open and the other strictly protected for commercial harvesting. Plants from four populations along elevation (3800-4800 m) and harvest gradients of each site were compared and the relationships between density, biomass and environmental factors were modelled. A high level of harvest significantly reduced plant density and biomass. Moreover, plant density decreased with increasing elevation, implying that harvest of plant populations at elevations higher than 4500 m is deemed critical. Shrub and moss/lichen cover led to increase plant density in protected site; but in open site, heavier exploitation was found in shrubland population, as a consequence higher plant density was observed in rocky areas. *In situ* management of target species, with the involvement of local collectors is essential and with a provision that certain number of reproductive individuals must be left after each harvest event to maintain population viability.

Key-words: ramet density, biomass, mixed modeling, harvest gradient, micro-habitat.

CSU-O 18

Effects of Habitat Heterogeneity and Anthropogenic Disturbance on Fitness-Related Traits of *Nardostachys grandiflora* in Langtang National Park, Nepal

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Abstract

Nardostachys grandiflora DC., a high value medicinal plant species of the Himalaya, is facing a serious threat due to trade-driven over harvesting of its underground rhizome and habitat destruction. We assessed habitat variables affecting population size and structure, and fitness-related traits of *N. grandiflora* in subalpine and alpine habitats in Gosainkunda area, central Nepal. We stratified the study area into five sites according to altitude and human disturbance. Habitats in subalpine and alpine levels differed greatly in terms of vegetation composition, substrate characteristics and anthropogenic disturbance. Disturbance and vegetation cover were related most with the population density and fitness-related traits. The combined effects of grazing and harvesting resulted in the reduction of sexual reproduction and retardation of ramet recruitment. In conditions of high disturbance and greater competitive stress due to high graminoid vegetation cover in alpine habitat, *N. grandiflora* was found to invest more on vegetative than on sexual structures. The study revealed poor fitness of *N. grandiflora* in alpine as compared to subalpine habitat. Immediate management action is needed to protect the species from illegal and premature harvesting. As the survival of adults is the most important life history parameter for population persistence, the management should focus on reducing its damage. Long-term management plan is needed for sustainable utilization and protecting the remaining populations from illegal harvesting.

Key-words: medicinal plants, vegetation, ramet density, sustainable utilization.

CSU-O 19

Estimation of Annual Allowable Cuts in Community Forestry in Tanzania: Ambiguities of Participatory Forest Inventory and Yield Estimation Methods

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Abstract

In Tanzania, professional foresters may use any of the three forest inventory and yield estimation methods to estimate Annual Allowable Cuts (AACs) in the community forestry (CF). These include Participatory Forest Resource Assessment (PFRA), Partial Participatory Forest Inventory (PPFI) and Participatory Forest Inventory and Analysis (PFIA). So far, there is no empirical study carried out to compare AACs that were estimated using each method. The aim of this study was to estimate and compare AACs using the said methods and explaining its implications on CF objectives: improving forest condition and local communities' livelihood. The study was conducted in Mindu Village of Tunduru District, Southern Tanzania. The village owns a forest covering 3713 ha of which 3336 ha is set aside for timber production. Three forest inventories were carried out in the same forest, applied inventory designs, and measurement procedures, as prescribed in the guidelines for respective method. Estimation of AACs for a most popular commercial hard wood tree species, *Pterocarpus angolensis*, was done based on yield estimation procedures prescribed by each method. The results show that AACs estimated by PFIA = 42m³, PPFI = 84.08 m³, and PFRA=0. Of three methods, PFRA suggesting no timber harvesting, thus, allowing forest improvement in expenses of local communities' livelihood. The rest suggesting harvesting, but there is a big difference of estimated AACs between the two, indicates imbalance in addressing CF objectives. Therefore, the study calls for harmonization of the methods.

Key-words: Mindu Village, Tanzania, sampling design, *Pterocarpus angolensis*.

CSU-O 20

Growth and Dynamics of *Abies spectabilis* With Climate Change at Tree Line Ecotone in Western Nepal

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Abstract

Climate change in the Himalayas has shown multiple impacts in diverse sectors. Elevation shifting rate and climate-growth relationship of *Abies spectabilis* (D. Don, Fir) was assessed in Myagdi, Nepal. Three quadratic plots in transect along the elevation gradient of each aspect were selected for core sampling. Thirty years' climatic data was taken for climate analysis. Numbers of tree rings and width of sampled cores were measured using LINTAB and cross dated on TSAP-Win software. ARSTAN program was used for standardization and chronology development. Biophysical parameters of dominant trees were found to be decreasing with an increase in elevation in both aspects. Upward range shifting rate in decade is 8m in SE and 3m in NW aspect. A 116 years long site chronology dated back to AD 1898 was developed. Average annual radial growth was found 2.58 mm. Growth-climate relationship revealed that there was a positive correlation between the radial growth of Fir and current year October precipitation ($p < 0.03$) and August temperature ($p < 0.02$) whereas negative correlation with August precipitation ($p < 0.03$). The growth of Fir in area was mainly controlled by August climate. Tree ring study is useful to assess the vegetation dynamics, and also to know trees response on climate change.

Key-words: tree line, growth parameters, dendrochronology, cross dating.

CSU-O 21

**Vegetation Cover Change and Associated Factors
in the Mid-Hill Region of Nepal**

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Abstract

Vegetation cover changes with respect to management practices, demographic conditions, socio-economic changes and other natural disasters. However, role of the different factors affecting the forest cover change in Nepal is less explored. Considering this, this study documents on vegetation cover change in the Madi Khola Watershed representing mid-hill region of Nepal and identify factors associated with the vegetation cover change. Landsat imagery from same season (October/November) for the years 1995 and 2016 were used to prepare the vegetation cover. Furthermore, secondary sources of information especially demographic data of the census 1991 2011, community forest registration records and other data base were used to determine associated factors, such as population density, forest dependency, source of income, road density, availability of the agriculture land etc. The regression analysis was developed to assess relationship between vegetation cover and other factors using the past local administrative VDC boundary ($n = 50$) as the unit of analysis. Result showed that vegetation cover between two periods had largely increased, which might be due to initiation of the community forest programme in the district. This is mainly due to migration and changes in the occupation of the family members. Spatial analysis in terms of road accessibility and topographic complexity shows forest cover improvement has negatively correlated with road and positively with the extent of availability of agriculture land. Forest cover change is combined results of management, demographic changes and socio-economic characters of associated communities.

Key-words: vegetation, demography, socio-economic, community forest.

CSU-O 22

Traditional Natural Regeneration Protocol of Sal (*Shorea robusta*) with Special Reference to Changing Climate in India Affecting its Distribution and Germination Pattern

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Abstract

MDGs goal no. 7 focuses on ensuring environmental sustainability. The WSSD provided a platform to achieve sustainable development under the WEHAB (Water, Energy, Health, Agriculture and Biodiversity) initiative framework. In view of the aforesaid framework, CGSMPB had developed traditional regeneration and conservation technique of *Shorea robusta* with community participation in forest of Chhattisgarh State, India. *Shorea robusta* is a climax species of tropical deciduous forest of Central India which forms pure stands in Chhattisgarh state but it is most affected by development programs. Sal itself is a medicinally valuable species. Though the regeneration of Sal in some areas is profuse but conservation of regeneration, however, has been a serious problem in Sal forest management. Hence a traditional regeneration protocol is developed with participation of community. The aim was to develop traditional natural regeneration and conservation protocol of Sal and assessing the effect of termite mounds soil on the germination behavior of Sal seeds involving community. The seeds were collected from Sal forests of 3 agro-climatic zones of state and sown by traditional practice and progress of germination was observed and recorded weekly up to 14 days. Statistical “W” (Shapiro-Wilk normality) were applied. The population class analysis was derived by a regression equation based on negative exponential model. The 15 sites in Chhattisgarh under 3 agro-climatic zones were Bastar Plateau, Chhattisgarh Plains and Northern Hills. We observed that site 1, 2,

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3, 10 and 13 had shown good regeneration status, site 9, 12 and 14 had shown fair regeneration status; whereas site 4, 5, 6 and 11 had shown promising regeneration and site 7 and 8 had shown poor regeneration. The study indicates that the regeneration technique may lead us to achieve the target of Millennium Development Goals.

CSU-O 23

Diversity of Useful Plant Species along an Elevation Gradient in Jaljala Mountain Area, Rolpa, Western Nepal

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Abstract

Documentation of useful plant species is a major focus in ethnobotanical research. This study aimed at documenting useful plant species, analyzing their importance and assessing their diversity along elevation gradient in Jaljala Mountain, Rolpa, Nepal. We prepared a list of useful plant species and documented their detail use through ethnobotanical interviews with healers, elderly people and other general users. We studied richness of useful plant species along an elevation gradient (2200-3400 m asl), covering seven major vegetation types. We used 10 × 10 m plots ($n = 42$) and followed stratified random method for sampling the vegetation. A total of 175 plant species, belonging to 73 families and 144 genera, identified in this study as useful, were grouped under 10 major use categories. Highest number of species was recoded under medicinal (83) and food (75) use categories. Based on the use value index, the most important species were *Aconitum gammiei*, *Swertia chirayita*, *Bergenia ciliata*, *Rheum austral* and *Taraxacum parvulum*. Of the 10 major use categories, richness of species under medicinal use category showed unimodal relationship with elevation. In general, richness of useful plant species was high at lower elevation alder-oak and mixed broadleaved forests. However, all of the studied forest types harbor species with high conservation and local use values. Therefore, management of ethnobotanically useful plant species should be given priority with the integration of landscape with different habitat/vegetation types, component species and associated local knowledge.

Key-words: ethnobotany, useful plant richness, elevation gradient, use value index.

CSU-O 24

**Development of Above Ground Biomass Estimation Model
of *Shorea robusta* at Juvenile Stage**

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Abstract

Shorea robusta, a major timber species in Nepal, contributes around 28.2% in total standing volume. Despite its high importance, forest degradation and deforestation in the centralized forest management system remained high in the past. After the introduction of community forestry, these forests have been rejuvenated gradually. The juvenile plants thus in Nepalese forests are of high importance not only to regain forests but also for biomass production. This study was carried out to develop allometric equation to estimate above ground biomass of *Shorea robusta* from Kankali community forest of Chitwan district, Nepal. The diameter (D) 10 cm above the ground level and total height (H) from the base to tip of the juvenile was measured after felling for 155 juvenile. The density of wood (ρ) was determined as ratio of dry weight and fresh volume of the sample disc from the main stem. The biomass was modeled as a function of (D, D², DH, D²H, ρ D, ρ D², ρ DH, ρ D²H) eight different model categories. The different model categories were subjected to the 18 different forms of models (i.e., $8 \times 18 = 144$ alternative models). The estimated models were evaluated by using numerical fit statistics (adjusted R², Root mean squared error, AIC) and through graphical analyses. We recommend the best fitted model of the form $W_i = 0.88 (\rho_i D_i^2 H_i)^{0.91}$ that explained >94% juvenile biomass of *Shorea robusta* with RMSE = 87.10 g and AIC = 1997 to estimate the above ground biomass of juveniles of *Shorea robusta*. We conclude that the use of estimated model can reduce measurement errors while estimating above ground biomass of *Shorea robusta* at juvenile stage compared with traditional measurements.

Key-words: biomass, wood density, allometric equation, model error.

CSU-O 25

Interaction between Tree Phenology and Meteorological Variability in a Mixed Deciduous Forest

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Abstract

The research was carried out in Hainich National Park, Germany. The forest species, beech (*Fagus sylvatica*), ash (*Fraxinus excelsior*) and maple (*Acer pseudoplatanus* and *A. plantanoides*) were selected for phenological study. The meteorological data was collected from 2000-2014 from a micro-meteorological tower inside the park. Leaf phenology (bud burst) timing, from 2000-2014, was studied using captured images that were taken by the camera fitted on the tower and then correlated with meteorological variables. During the study, beech and maple showed an early bud bursting trend while ash showed late bursting but insignificant in a fifteen years period. There was a significant negative correlation between average temperature of spring and pre-spring for maple and beech whereas not significant for ash. The bud burst was in decreasing trend for maple by 4.62 days °C⁻¹, for beech 4.71 days °C⁻¹ and for ash 1.95 days °C⁻¹ with an increase in spring temperature. Likewise, the bud burst of maple and beech showed significant positive correlation with summer and pre-spring precipitation with trend of +0.08 to +0.09 days mm⁻¹ and weak correlation for ash. There was no significant correlation between spring soil temperature and bud burst of species. The future climate change with presumably early spring warming or late chilling winter periods will lead to a radical change in bursting patterns of beech, maple and ash.

Key-words: phenology, climate change, meteorological variability.

CSU-O 26

Status, Distribution and Potentiality of Non-Timber Forest Products (NTFPs) of Taplejung District, Eastern Nepal

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Abstract

Having two (Eastern Himalayan broadleaf and coniferous forests and Eastern Himalayan alpine meadows) of the Global 200 eco-regions, Taplejung district harbors valuable NTFP species. The study analyzed district scenarios of NTFPs, assessed major NTFPs, their density and frequency, spatial distribution using primary and secondary data. NTFP species were prioritized based on eight criteria using matrix priority ranking tool. The study adopted non-destructive sampling method. Stratified multistage sapling design was deployed for arranging sample plots in the study. NTFP effective areas were delineated on topographic map of scale 1:50000 with the help of CFUGs and these affected areas were digitized on digital layer of topographic map. Finally, sample plots (of size 25 square meter) were randomly laid out within the affected area with the help of ArcGIS 10. Altogether, 576 sample plots were laid out for NTFP species' inventory. Out of 46 NTFP species found in sample plots, twenty five species have been prioritized for cultivation and managed trade. Frequency ranges from 0.35% (*Nardostachys grandiflora*) to 30.21% (*Swertia chirayita*), while density per hectare ranges from 5 (*N. grandiflora*) to 533 (*S. chirayita*). Potential area map of 10 prioritized NTFPs were produced using digital layer of contour map and land use map. Out of 106 NTFP species found in study area, 28 species are being collected and traded from national and community forests. Due to limited traders and competition, only elites are getting benefits from NTFP trade. Benefit diversification is indeed necessary to channel benefits to local CFUGs.

Key-words: NTFPs, inventory, ArcGIS 10, frequency, density, potential area map.

CSU-O 27

Isolation and Identification of Endophytic Fungi from Medicinally Important *Dendrobium moniliforme* to Study Their Plant Growth Promoting Activity and Production of Secondary Metabolites

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Abstract

Endophytes are microbes that make symbiosis with the host plant. They may be bacteria or fungi that colonize the host plant tissue to complete the part of its life cycle without harming the host plant. Such relationship is beneficial for both host plant and microbe. Endophyte have wide application in the field agriculture, horticulture, conservation and isolation of novel compounds, drug dicoverly. All most all plants in nature are associated with endophytes. But ecologically large number of endophytic fungi remain unidentified and uncharacterized. Orchid associates with endophytes throughout its life cycle. Orchid plants are colonized by a wide range of endophytes especially taxa belonging *Ceratobasidium*, *Sebacina*, *Tulasnella* and *Russula* species. More importantly, orchids are dependent on endophytes at different stage of their life cycle: seed germination, seedling elongation and maturation. Orchid seed lacks endosperm depends on endophytes for Carbon source, maturation and germination. Endopytes are considered as Immunodulator, Bioprotector and Biofertilizer. In this investigation, nine different types of fungi were isolated from *Dendrobium moniliforme* in Potato Dextrose Media to study their characteristic features and growth. The plant growth assay was performed with fungal elicitor prepared from isolated endophyte. Identification of secondary metabolites as well as plant growth hormone was done by Gas Chromotography Mass Spectroscopy (GC-MS).

Key-words: orchid, *Dendrobium*, endophytes, fungus, symbiosis.

CSU-O 28

**Integrating Traditional Knowledge and Practices of
Amchi for Medicinal Substitutes and Conservation
of Threatened Species in the Himalaya**

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Abstract

Sowa Rigpa (Tibetan Medicine, TM) has been practiced and appreciated in the Himalaya, China and Mongolia for centuries. This system of medicine is now under threat mainly due to limited supply and increased cost of some of the major ingredients derived from rare or threatened species of plant and animal. Promotion of appropriate substitute of threatened species is one the viable alternatives for the sustenance of TM. This study aims to investigate substitutes for the threatened species used in TM by integrating knowledge and practices of Himalayan *amchis* (practitioners of TM) from Nepal. Participatory methods were adopted to identify patterns, issues and aspects of substitution by involving 50 *amchis* from Mustang, Dolpo and Kathmandu, Nepal. *Amchis* possessed immense knowledge on substitution identifying over 50 ingredients commonly derived from plants, animals and minerals as substitutes for rare and threatened species. The major modes of substitution are: plant-plant, animal-plant, plant/animal-mineral and animal-animal. Substitution knowledge is mostly gained by *amchis* from ancient literature and secret oral transmission. However, the use of substitute also demonstrates a process of innovative experimentation by *amchis* with the properties of medicinal ingredients. This study has identified new perspectives of potential substitutes for threatened species and demonstrated that integration of traditional knowledge and practice of *amchis* is crucial in conserving biodiversity and sustaining cultural practices in the Himalaya.

Key-words: Tibetan Medicine, biodiversity conservation, traditional cultural practice.

CSU-O 29

Status and Response of *Lagerstroemia indica* to Air Pollution in Kathmandu Valley

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Abstract

Lagerstroemia indica is a multi-stemmed, summer flower color, attractive fall foliage, and drought-tolerance all combine to make a favorite shrub or small tree for either formal or informal landscapes. Air pollution is high due to various human need infrastructure development activities in the Kathmandu Valley. Present study was aims to assess the coverage, foliar damage, and dust deposition on leaves of ornamental plants along roadsides having high traffic density and less traffic density to find the variation in frequency, status and pollutants deposition on leaves with respect to species and seasons. *L. indica* was selected for the research. This study was conducted in different seasons and in various sites which were categorized as highly polluted, less polluted and control. The plants and leaves are used in analysis for their frequency and amounts of pollutants deposition. The ranges of availability and dust deposition of selected species at different sites were studied. *L. indica* prominently available in control sites rather than in polluted sites. Heavy traffic site Kalanki is with less availability. During winter season in polluted sites, leaves were more appropriate to pollutants deposition among in other selected species. Aphids often infest the new grow on the foliage. Heavy aphid infestations cause detracts from the leaves appearance. Generally plants available in residential area and has been successfully grown in urban areas where air pollution, poor drainage, compacted soil, and drought are common. It is highly recommended for planting in urban and suburban areas.

Key-words: air pollution, *Lagerstroemia indica*, pollutants, plant leaves, roadsides.

CSU-O 30

**Ongoing Practices and Issues in Mainstreaming
Biodiversity and Ecosystem Services in
Community Forestry**

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Abstract

Mainstreaming can be understood as causing factor to be included in or accepted by the group that includes most people. Need for mainstreaming in the field of biodiversity was recognized by Convention on Biological Diversity in 2010. Federation of Community Forestry Users Nepal (FECOFUN) is a formal network of Forest User Groups from all over Nepal. Since its established in 1995, it has been working to develop means of livelihoods, to generate opportunities to reduce poverty through sustainable forest management and utilization of resources, and to create awareness among user groups about endangered species and importance of bio-diversity with initiation to promote and encourage the traditional knowledge of local community in management of bio-diversity and protection of endangered species. The provision of spending 25% of income of community forestry (CF) for the management of forest has resulted in improvement of habitat for wildlife. Besides, controlling soil erosion by CF has improved greenery and availability of water resources, and opportunities for livelihood. This paper presents provision of mainstreaming biodiversity mentioned in Forest Act of Nepal, contribution of CF in biodiversity conservation including threatened species, challenges seen for biodiversity conservation in CF, functions related to relief and compensation, and future strategies and coordination of FECOFUN for mainstreaming biodiversity and ecosystem services in CF.

Key-words: mainstreaming, biodiversity, community forestry, conservation.

CSU-O 31

Sacred Forest Vajrabarahi, Nepal and the Attitude of Local People towards Conservation; an analysis

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Abstract

The sacred forests of Vajrabarahi symbolizes age-old traditions of the management of forest in participation of community. This study uses social science research methods in the Vajrabarahi to determine the perception of local people towards the sacred landscape and the exploration of the management strategy and structure and rituals associated with the forest itself. Interviews among five mixed age groups local communities surrounding the sacred forest revealed attitudes of local people towards its conservation. This study compensated for the need of a social research to the prior research on conservation through species exploration and multivariate models analysis in the forest. The disturbance effect on species richness has shown to follow Intermediate disturbance hypothesis. The locals identified gradually changing perception of a 'sacred' landscape and hence need new conservation paradigm and showed an increase in the use of forest more as an entertainment venue rather than usual venue for cultural events or sacred rituals. The management seemed enticed and sometimes pressured from locals to convert the forest resource into an income generation source while the perception of the young population seems growingly indifferent towards the traditional 'sacred landscapes' concept. Need of a new strategy that combines element of scientific study and rationale behind traditional concept in amalgamation should be developed, which is recommended.

Key-words: community management, sacred forest, conservation practices, Vajrabarahi, Nepal.

CSU-O 32

**Dynamics of Species Diversity and Tree Volume in
Tree Outside Forest, Nepal**

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Abstract

Tree Outside Forests (TOFs) are considered as important for maintaining biodiversity and has significant ecological values. Present study has the objective to show the variation in volume and to estimate the species diversity dynamics in TOF. This study was carried out in Dhangadhi VDC in Siraha district using stratified random sampling in two strata of cluster and scattered plantation. Altogether 33 samples were taken for the study representing 21 sample plots having 32*32m² were laid in cluster plantation while 12 sample plots with 50*50m² were set in scattered plantation to collect the data of number of species, DBH and height of the tree. Species diversity was calculated using Simpson's and Shannon Weiner index. Moreover, the volume was calculated using DBH, height and form factor. The Shannon Weiner index value was compared between two strata using t-test. The species diversity was the highest in scattered plantation (20 species) and 6 species was found in cluster plantation. The major species were *Mangifera indica*, *Eucalyptus camaldunsis*, *Dalbergia sisoo* for the plantation in TOF. The maximum volume was found 50.43m³/ha for *Mangifera indica* followed by 19.12 m³/ha of *Eucalyptus camaldulness* for cluster plantation where as in the scattered plantation *Eucalyptus camaldulnes* (4.65 m³/ha) followed by *Dalbergia sissoo* (4.16 m³/ha). The values of Simpson and Shannon Weiner indexes were 22.6 and 0.84 in cluster and 1.09 and 2.31 in scatter. The t-test showed there was significant difference in Shannon Weiner index between TOFs of cluster and scatter at 5% level of significant.

Key-words: DBH, species diversity, trees outside forests, tree volume.

Conservation and Sustainable Use (Poster)

CSU-P 01

Population Regeneration Status and Use Potential of *Daphne bholua* Along an Elevation Gradient in Madane Protected Forest, Gulmi, Western Nepal

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Abstract

Daphne bholua Buch.-Ham. ex D. Don is a potential non-timber timber forest product (NTFP) whose bark is extracted for making hand-made paper. Studies pertaining to its population status are limited in Nepal. We evaluated its population status, including its regeneration potentialities and life history traits along an elevation gradient in Madane Protected Forest, Gulmi, Western Nepal. Altogether, 108 plots (5 × 5 m) were established along nine elevation bands each of 200 meter elevation interval. Total elevation range of the species was 1800-2650 m. The mean density of *D. bholua* was maximum in the highest elevation band (2400-2700 m) and minimum in the lowest band (1800-2100 m). In majority of cases, regeneration was limited with root suckers and coppice outgrowth. The flower production and seed set was very poor and poorest at lowest band. In the study area, bark of *D. bholua* is harvested only for local use purpose and are yet to be commercialized. People harvest its bark according to their need and the amount harvested at present seemed to be sustainable. However, *D. bholua* populations at lower elevation band were affected greatly by grazing and trampling effects and also by developmental activities, such as road construction. The present stock of *D. bholua* in Madane Protected Forest area is in satisfactory condition with potential for sustainable harvest and management, which could serve as best income generating resource to the local people.

Key-words: bark harvesting, *Daphne*, hand-made paper, income, sustainable harvest.

CSU-P 02

Status of Mushroom Cultivation and Wild Mushroom Poisoning in Chitwan, Nepal

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Abstract

Study on status of cultivation and poisoning of wild mushroom was conducted by selecting Chitwan District of Nepal purposively. Mushroom is no doubt the best nutraceuticals enriched vital nutrients and has almost no fat. The forested areas of Chitwan had always been a good source of wild mushroom and marginalised communities would collect and consume it. Interestingly, mushroom was not accepted by all in the society and was considered to be completely wild product. However, change in taste and preference have shifted in couple decades and mushroom cultivation have picked up. Various institutions were surveyed and poisoning data was obtained from Government Hospital, Chitwan. Though under documented, mushroom poisoning is higher in context of Nepal and reported incidences are higher in female followed by male. The ethnicity of affected are Janajatis followed by Tharus, 20 to 30 age group followed by 10 to 20 and hilly belt followed by southern periphery of Chitwan National Park settlements. Wild mushroom is also sold commercially on a small scale, prices and species vary seasonally. On the other hand, government of Nepal through its agriculture development program provides good subsidy, spawns for commercial cultivation. Through the ministry of health educating on identification of poisonous mushrooms and discouraging consumption of wild mushrooms is done. Currently, about 55 farmers are involved in commercial mushroom farming in Chitwan. Poisoning trend seems to be highest at 2069 B.S. followed by 2070 B.S. and is exponentially decreasing. The findings indicated that mushroom cultivation can be taken as a tool to increase production and economic status of farmers of Chitwan while saving lives from wild poisonous mushrooms.

Key-words: cultivated mushroom, wild mushroom poisoning, Chitwan.

CSU-P 03

Conceptual Framework on Enhanced Local Adaptation Plan for Action (LAPA) Preparation

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Abstract

Adaptation to the climate change cannot effectively occur unless the planning process adopts an ecosystem based approach. The livelihoods of smallholder farmers depend on natural systems that extend beyond administrative boundaries. Therefore, to enhance the climate resilience of the natural environment and to sustain ecosystem services, the needs of the environment at a larger ecosystem level must be considered in Adaptation for Smallholders in Hilly Areas (ASHA) Project. This poster highlights the novel approaches for covering natural boundary of climate change adaptation plan by adopting the enhanced approaches for LAPA preparation and also contributes to fulfill the gaps identified in existing LAPAs preparation. These approaches are GIS based sub-watershed and Participatory Scenario Development (PSD). Since, GIS based sub watershed assessment is necessary in order to support for ecosystem level resilience building by addressing upstream and downstream linkages whereas PSD is necessary for envisioning future for balancing both development and ecosystem needs".

Key-words: enhanced LAPA, Participatory Scenario Development (PSD), GIS, sub-watershed.

CSU-P 04

**Analysis of Present Status of Certified Community Forests
in Dolakha District: An Eye Opening Exploration**

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Abstract

Forest certification has emerged as one of the voluntary, market-based initiatives and soft policy instruments to improve forest management practices. It has proven to be one of the appropriate tools in promoting the well-being of forests at par with community. This study was conducted in two certified community forest of Dolakha district to access the present status of the forest with respect to impact of forest certification on livelihoods and perception of local community for the continuation of forest certification. Based on the stratified random sampling, 96 respondents from two CFUGs were randomly selected and asked their experiences and opinions about past and present certified forest management practices and benefits accrued from certified forest management. Positive trends in management practices were identified. Budgeting and working systems have become more transparent and supportive programs for the poor have also been observed increased. Overall, awareness of the CFUG in forest certification was found at moderate level. Most of the people were satisfied and their attitude was mostly positive towards forest certification. Compared with social and environmental benefits, the economic benefits from forest certification have been found to be quite low. However, overall status of present management practices in certified community forestry was found moderately well. Most of the management practices and application of new technologies required by forest certification has been inadequate which may be due to lack of skilled manpower, and sufficient knowledge and funds. The devastating earthquake of 2072 has greatly affected forest management activities in both CFUGs.

Key-words: forest certification, sustainable forest management, livelihoods, impact, continuation.

CSU-P 05

Unleash the Potentials and Challenges of Scientific Forest Management in Community Forest in Nawalparasi District, Nepal

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Abstract

The traditional management practice of forest is not harnessing the potential production to meet needs and demand of the increasing population. Therefore, forestry of Nepal has entered in the new era of Scientific Forest Management (SFM). It refers to the systematic application of forestry science knowledge for the management of forest, based on the correct assessment of attributes of forest crop to maximize and sustain benefits accruing from the forest (MFSC, 2014). The study was carried out in Shree Jana Jagaran Community Forest, Nawalparasi District. Implementation and practice of SFM is in initial phase. The study was focused on exploring the opportunities and challenges of SFM in community forest. The study found that improvement and protection of forest, maintenance of greenery, encroachment control, enhancement in carbon sequestration, and wetland and biodiversity conservation were the major environmental opportunities. The production of timber was enhanced by 10.19 times and 11.18 times more fund collection and job creation opportunities than the traditional forest management. Livelihood support to local people, rural development, raising awareness, skill and capacity development were the major social development opportunities. The major challenges were appropriate protection of forest, biodiversity conservation, and sustainability of income source. Distant users and women need to give priority in awareness and skill development activities. Frequent monitoring, arrangement of strong communication network and forest fire control mechanism is crucial to develop for the protection of forest and biodiversity conservation. Motivate people for stale feeding their cattle by

providing improved variety grasses or support them with alternative means for their livelihood to control open grazing in forest area is utmost important. The study concludes that the environmental, economic and social opportunities have been created by the implementation of SFM. The users believed that the program is socially acceptable, economically profitable and environmental friendly hence highly potential and appropriate for Terai sal forests management.

Key-words: forest management, scientific, traditional practice, sustainability.

CSU-P 06

Sub-Watershed Level Climate Resilient Agroforestry Practices for Smallholders

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Abstract

The increased climate variability associated with changing climate patterns is not only aggravating the challenges that farmers are already facing, but also putting people in new situations never faced before. Therefore, sub watershed level agroforestry diversifies the environmental and economic functions of small scale farming systems and is therefore considered more resilient. Moreover, this poster presents the sub watershed level agroforestry interventions identified from sub watershed assessment for building climate resilience and to diversify the livelihood options and profitable production of most vulnerable groups at different agro ecological zones.

Key-words: agroforestry, sub-watershed, resilient, smallholders.

CSU-P 07

Karyotypic Analysis of four Species of the genus *Blumea* (Asteraceae) from Nepal

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Abstract

In this study, chromosome number determination and karyotype analysis of four species of the genus *Blumea* [*B. fistulosa* (Roxb.) Kurz, *B. lacera* var. *glandulosa* (DC.) Hook, *B. lacera* (Buem f.) DC., and *B. laciniata* DC; Family Asteraceae] was carried out. Plants samples were collected from central parts of Nepal. The chromosome number in somatic cells were recorded to be $2n = 22$ in *B. fistulosa*; $2n = 32$ in *B. lacera* var. *glandulosa*; $2n = 18$ in *B. lacera* and *B. laciniata*. The range of chromosome length was found to be 0.6-1.6 μm in *B. fistulosa*, 0.6-1.6 μm in *B. lacera* var. *glandulosa*, 0.6-1.7 μm in *B. lacera* and 0.8-1.6 μm in *B. laciniata*. Karyotype formula for *B. fistulosa* is $M_{12} + sm_{10}$, for *B. lacera* var. *glandulosa* is $M_{14} + sm_{14} + st_4$, for *Blumea lacera* is $M_{14} + st_2$, and for *Blumea laciniata* is $M_{12} + sm_6$. In this investigation, a pair of satellite chromosome was found in *B. fistulosa* at the end of short arm of chromosome. Mainly three types of chromosomes were observed in this study having centromere at middle point, at sub-median region and at sub-terminal region. All four species of *Blumea* in this study were found to be in polyploid forms hence these are evolutionary significance. Similarity, size of chromosomes and karyomorphology indicates the homogeneity of the taxa within this tribe.

Key-words: karyotype, chromosome number, Asteraceae, chromosome length.

CSU-P 08

Soil Carbon, Nitrogen and Texture Dynamics at Root Zone and Between Plants in Riverine Plantation of *Acacia catechu*, *Dalbergia sissoo*, *Pyllanthus emblica* and *Eucalyptus camaldulensis*

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Abstract

This research was carried out to assess the dynamic of soil C, N and texture at root zone and location between plants. The plantation of *Acacia catechu*, *Dalbergia sissoo*, *Pyllanthus emblica* and *Eucalyptus camaldulensis* of Pragati community forest, Mahottari Nepal was selected for this study. The stratified random sampling was applied to collect soil samples. Altogether, 320 soil samples were collected from 0-10, 10-30, 30-60 and 60-90 cm depths. The result showed that soil carbon was about 8.16 t/ha at root zone which was only 7.56 t/ha at location between plants at 0-10cm depth in *Emblica officinalis* stratum. The soil carbon was the least nearly 2.08 t/ha at root zone which was 1.59 t/ha at location between plants in *Eucalyptus camaldulensis* stratum. The carbon percentage was the highest about 1.35% at root zone of *Emblica officinalis* stratum. However, the C/N ratio was the highest about 69:1 at location between plants of *Dalbergia sissoo* stratum. The texture of soil was loamy sand at root zone in *Emblica officinalis*, *Acacia catechu* and *Dalbergia sissoo* plantations while it was sandy at both root zone and between plants of *Eucalyptus* plantation. Plantations have significant effect on soil Carbon and Nitrogen at 95% confidence level.

Key-words: root zone, plant carbon, nitrogen, soil texture.

CSU-P 09

**Population Dynamics of *Uraria picta* and
Andrographis paniculata in the Buffer Region
of Tadoba-Andheri Tiger Reserve**

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Abstract

Non-scientific commercial extraction of NTFPs affects survival, growth and reproduction of harvested individuals and thereby affects density, distribution, population structure and dynamics of this valuable natural resource. There are various indices to assess the status of the population, population growth rate being just one of them. In the current study population, dynamics of *Uraria picta* and *Andrographis paniculata* was studied using Matrix population models. Four populations of *Uraria picta* and seven populations of *Andrographis paniculata* were identified for study. The study was undertaken in the Buffer region of Tadoba-Andhari Tiger Reserve, Maharashtra India. The growth rate of population depends upon the life cycle and the reproductive behavior of the organism, but at the same time, the effect of interaction of organism to its environment and other biological factors cannot be neglected. Out of the four identified populations of *Uraria picta*, only two showed positive population growth. It was found that a minimum density of one plant per square meter should be maintained in the suitable habitat to support a viable population of *Uraria picta*. The population projection of *Andrographis paniculata* showed that all the seven populations identified for the study are stable. Seed germination was poor at all the sites. However, the loss of the population due to poor seed-germination is compensated by high seed production per individual.

Key-words: *Uraria picta*, *Andrographis paniculata*, population growth rate, biological factors, seed germination.

CSU-P 10

Quality Assessment of Churia Sal (*Shorea robusta*) Forest with Emphasis on Timber Production

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Abstract

Knowledge on stem quality and assortment structure in forest is highly important for policy makers and the timber industry for different time periods. Sal (*Shorea robusta*) is important species in lowland of Nepal due to its incredible use and species richness. Present study was carried out in two community forest in Makawanpur district to find out the forest quality for timber production by analyzing forest condition and other quality indicators. Forest Inventory was conducted with 0.5% sampling intensity with systematic random sampling design following the community forest inventory guideline approved by the government of Nepal. The site variable measured (pH, Organic Matter, NPK content and soil texture) explained the soil condition of forest. Both community forest were of good in quality with timber volume of 86m³/ha and 151m³/ha in Chuchekkhola CF and Neureni-Chisapani CF respectively. The ranking of preferred species for timber purpose was done to prioritize the species by users and hypothesis testing was done by using Friedman two-way ANOVA test to test the validity of this ranking. *Shorea robusta* followed by *Terminalia tomentosa* was found to be most preferred timber species. The most disturbing factor was forest fire followed by tree cutting and plant disease as the least disturbing factor identified by using Likert scale and Weighted Index Value Awareness on forest pest, disease and proper fire management plan have been recommended for the effective management of both Community Forest in sustainable basis.

Key-words: community forest, disturbance factors, forest quality, preferred species, timber.

CSU-P 11

Diversity of Medicinal Plants in the Conservation Areas of Chhattisgarh and Strategies for Their Conservation

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Abstract

The present study was conducted in the Medicinal Plant Conservation Areas of Chhattisgarh state of India. There are 14 such areas in the state, which are managed as hands-off area for in-situ conservation of identified flagship species by the local communities under the auspices of Chhattisgarh state medicinal plant board. These areas are protected and managed by JFMC which also harvests medicinal plant, process and sell it and the usufructs of the same is distributed among the beneficiaries. In the present study the medicinal plants of each MPCA was recorded. Medicinal plants of conservation priority were identified for each MPCA based on abundance, density and distribution. Linking of in-situ and *ex-situ* conservation was suggested for conservation and sustainable use of the identified species.

Key-words: medicinal plant, JFMC, conservation-priority, *ex-situ* and *in-situ* conservation

CSU-P 12

**Nutritional Value of Some Wild Edible Macro-Fungi from
Bhimsen Rural Municipality (Dhawa), Gorkha district,
Central Nepal**

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Abstract

The wild edible macro-fungi, mostly consumed by local inhabitants, were collected from community forest of Bhimsen Rural Municipality in Gorkha district, Nepal. The study was carried out during monsoon season covering different habitats. The collected samples were preserved and identified. Nutritional values of seven dominant edible species were made following the standard protocol. Seven dominant macro-fungi, namely *Termitomyces heimii*, *Lactarius volemus*, *Amanita chepangiana*, *Amanita hemibapha*, *Pleurotus ostreatus*, *Astraeus hygrometricus* and *Ramaria botrytis* were subjected for the analysis of nutrient content, mainly protein, lipid, fiber and carbohydrate. Protein content ranged 7.34-48.11%, lipid content ranged 0.25-8.31%, fiber content ranged 6.45-24.00%, carbohydrate content ranged 41.74-80.00%, and energy content ranged 2335.05-4185.23 calg⁻¹. The mineral analysis showed 0.43-1.39% of calcium and 0.20-0.63% phosphorus in the studied macro-fungi. *Termitomyces heimii* contained highest amount of protein (48.11%) among the macro-fungi studied. As all the studied macro-fungi possessed significant proportion of nutrients and minerals, these could address nutritional requirement of local inhabitants and could serve as a potential species for domestication and commercialization.

Key-words: wild edible macro-fungi, proximate nutritional value analysis.

Theme 3: Policy and Governance

(Oral presentation)

PG-O 01

Policy and Governance in Timber Harvesting: A Case Study of Collaborative Forest in Nepal

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Abstract

Government policy and program focuses to increase production and productivity of forest in Nepal. It has given priority to increase forest products and services so that the demand of timber and other products will be fulfilled from the forest. To fulfill the market demand, government has initiated Scientific Forest Management (SFM) program in different forest sizes and regimes, including collaborative forest in Terai. Collaborative Forest Management (CFM) is the partnership model of forest management where community, government and other stakeholders involve in forest management and decision making process. Currently, SFM program has been initiated in different CFM sites in Terai. In this paper, I have analyzed the policy and governance of CFM especially in timber harvesting under SFM practices. The case is generated through qualitative case study of two CFM; Baraban CFM Kailali and Pathari Sanischare CFM Morang, and explored whether the CFM institution can be effective, efficient, and equitable in implementing sustainable harvesting of timber. This study concludes that participatory planning, monitoring and good governance of CFM are the contributing factor to promote sustainable timber harvesting in Terai. Similarly, conducive policies and laws, transparent process in all critical points, wider participation of stakeholders, use of local forest workers during harvesting, and equitable distribution of resources and opportunities support enabling environment for timber harvesting. In conclusion, inclusive governance and transparent process supports CFM institutions implementing a sustainable timber harvesting plans as well as biodiversity conservation in CFM site in Terai.

Key-words: collaborative forest, scientific forest management, policies, governance.

PG-O 02

Reclaiming Power in Community Forests: A Case from the Scientific Forestry Initiatives in the Hills of Nepal

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Abstract

Based on intensive case studies of two community forests in a Western Hill district of Nepal, this research explains how powerful actors regain power over decentralized forest resources through the use of scientific forestry narratives in community forests. We used “actor centered power theory” to identify powerful actors, their underlying interests and how they applied different elements of power to pursue their interests. The results show that powerful actors, especially local forests bureaucrats, created an interest in the scientific management of community forests by convincing forest user groups of the need to promote sustainable management and also obtain predictable harvests. Similarly, using the concept of scientific forestry as a seemingly sound narrative, the powerful actors expanded their involvement in all aspects of community forest management, especially in planning and harvesting operations, by using different elements of power, including trust, incentives, coercion, and avoidance. We argue that local level forest bureaucrats are becoming increasingly powerful through re-establishing control over decentralised forest resources. In the process, forest users lose their rights to governing forest resources in exchange for becoming extended arms of the forest bureaucracy.

Key-words: power, scientific forestry, actors, Nepal.

PG-O 03

Can Community Benefit From The Forest Carbon Trade?

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Abstract

Carbon sequestration by the forest biomass is the effective way not only to combat global warming, but also considered as one of the potential sources of generating funds for conservation and poverty reduction. Given the high dependency of the local communities on the forest products, especially firewood and timber, the community may on benefit from the carbon trade in small scale community forests. Considering this, the study estimates an annual net surplus of the carbon stock available for trade in the community forests and explore whether the community can benefit or not. Forest carbon measurement was carried out in two *Sal* dominated community forest of the Tanahun District following the carbon measurement guidelines, 2014 of the government of Nepal while annual increment on the carbon stock was estimated following community forest inventory guidelines, 2004, and validated by other studies. Also, statistically represented household survey was conducted to estimate forest biomass consumption, especially from timber and firewood. Similarly, record analysis, focus group discussions, and consultations with forest officials were carried out. The study estimated an annual increment of the forest biomass carbon at 2.4 ton/ha with the annual consumption at 2.3 ton/ha, revealing that almost all additional carbon has been consumed. Hence, the community is less likely to benefit with the current level of consumption of forest products. Furthermore, direct trading of the forest products generates more income than carbon itself. Local communities can only benefit if they are paid either for maintaining carbon stock or by reducing dependency on the forest biomass consumption.

Key-words: carbon, trade, community forest, biomass.

PG-O 04

Community Forests Management in Nepal: Experiences of Federation of Community Forestry Users, Nepal

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Abstract

Out of 147,181 km² total land area of Nepal, 36,360 km² is covered by total forest area (about 44.75%). About 68% is managed by the government and 32% is managed by the community, the most popular and successful forest management in Nepal. The Federation of Community Forestry Users Nepal (FECOFUN) is a formal network of Forest User Groups (FUGs) from all over Nepal. FECOFUN emerged from the idea that forest users from all parts of the country should be linked in order to strengthen the role of Users in policy making processes. Since its inception in July 1995 FECOFUN has grown into a social movement organization representing people who are forest users. It is a national federation of forest users across Nepal dedicated to promoting and protecting user's rights. In 2017, there are 19,361 Community Forestry Users Groups (CFUGs), covering 1,813,478 hectare community forestry area directly involving 2,461,549 Households. Total number of Women CFUGs is 1,072, covering 52,906.80 hectare community forestry area directly involving 107,075 Households. About 5.54% of FUGs are managed by women user groups only which covers about 2.92 % of total community forest area managed by mixed (both men and women users). This paper presents the forest management in Nepal, and experiences of community driven restoration programs, restoration improving livelihoods and biodiversity, working in partnership with government agencies and local communities and experiences of mobilizing communities by Community Forests.

Key-words: community forest, policy, FECOFUN, user's rights, restoration.

PG-O 05

Where Are We Investing for NTFP Development in Nepal?

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Abstract

Nepal has formulated various policies and programs for development of the non-timber forest products (NTFPs) of which Herbs and NTFP development policy (HNDP), 2004 is a notable one. Nepal government launched a program for NTFP development named '*Jadibuti Bikas Karyakram*' (NTFP development program) from the fiscal year 2009/010. Investments made through this program have not been reviewed yet. Programs of last three fiscal years were reviewed for analyzing where investment has been made through this program especially relating it with the provisions of HNDP. I categorized the budget in five broad categories: (1) resource conservation and development, (2) enterprise development and value addition, (3) institutional development, (4) coordination, extension and capacity building, and (5) research and development. The study revealed that in three years NRs. 717.411 million has been invested for NTFP development. Most of budget is allocated to resource conservation and development (37%), followed by the enterprise development and value addition (34%). Allocation for research and development is 3% in fiscal year 2014/015 and increased to 20% in 2015/016 but decreased to 3% in fiscal year 2016/017. Past studies showed that Nepal's NTFP could have higher medicinal value and needs investment to explore such value. But limited budget has been allocated to explore medicinal value of these NTFPs. Revisiting activities in line with the HNDP provisions with strong orientation towards research and sustainable harvesting is recommended for policy makers.

Key-words: budget, research, program, enterprise.

PG-O 06

Family Forestry in Nepal: Sustainable Management of Private Forest

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Abstract

Despite the global trends of decreasing forest covers, Nepalese forests are increasing (5.96 million ha, 40.36%). This trend is the result of the fact that farmers are adopting agro-forestry practices (family forestry) in their private lands. Private forest covers an area of about 54,900 ha; however, the area in reality is much higher as there are forest lands that remain unregistered leaving them out from the government records. These family forests besides conserving the national and community forest by meeting the household/local level needs, also contribute to national economy. In mid-hills, only family forest makes up of 22.8% of the household incomes. Family forestry is not a new concept in Nepal and has been in practice since the historic times. The government rules changing over times were only discouraging. Family forest farmers were restricted from trading the forest products on one hand and on the other permission has to be taken to trade the forest products, which is a lengthy process. Regardless of the contribution by family forest, forest farmers have been suffering due to the existing policy hurdle. Government imposes restriction for the trade and transportation of several species. It was the March of 2015 when Association of Family Forest Owners Nepal (AFFON) was formally established as a national level forum of family forest owners. Currently it has 36 district chapter and 5000 members associated with it. This paper discuss the aim of AFFON, achievement of its objectives and role against policy hurdle to secure the rights of the family forest farmers and economic transformation of the family forest farmers through the sustainable management of the forest they own.

Key-words: private/family forestry, economy, policy, AFFON.

PG-O 07

Public Perceptions about Their Role in Forest Management and Sustainability of Community Forestry in Mid-Hill of Far-West Nepal

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Abstract

More than three decades, government of Nepal has introduced and adopted the community Forestry (CF) program all over the country. Master plan for forest sector was key document for participatory forest management in Nepal. However, there is gap in research, related to public perceptions about their role in community forest management and sustainability of forest. The objective of this study was to evaluate the perceptions of local people towards their role in CF management and sustainability. Danshera CF was selected for study from Dadeldhura district of Far-West Nepal, considering gender, ethnicity, size of household and accessibility. Household interviews with questionnaire and focus group discussion were used to collect the data; and descriptive statistics were used to analyze the data. The study findings show that about 88.2% of respondents know about their role in CF and 96% of them agree that CF model is best for sustainable forest management in Nepal. About 55% male and 66% female know about sustainability of their CF. At the same time 71% respondents believed that they are users not managers of CF, 35% said that they are protectors than users and managers of CF. Women are more aware about sustainability of CF in mid-hill of Far-West Nepal. More participation of local people in policy-making and implementation process related to CF is required to change their perception and make them as manager of their CF.

Key-words: community forestry, gender, sustainability, perception, manager.

PG-O 08

Entrepreneurial Practice and Corruption in Wild Harvest Sector: A Study of Entrepreneurial Orientation and Organizational Corruption in Nepalese Herbs Enterprises

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Abstract

Entrepreneurship in wild harvest sectors, particularly herbs entrepreneurship has been considered as a meaningful contributor of country's Gross Domestic Product in Nepal. The herbs enterprises in Nepal has not only been generating revenues but also providing international identity of Nepal. In doing so, these enterprises are knowingly or unknowingly practicing different business strategies for achieving their international business benchmarks. Meanwhile, in economic development, corruption is labeled as negative facet. Out of different strategies, Entrepreneurial Orientation (EO) is regarded as an organizational strategy for achieving superior performance. The entrepreneurship literature also indicates that the corrupt practices happen for the sake of better performances. This study examines the relationship between EO and organizational corruption in Nepalese herbs enterprises. Post positivistic paradigm guided this study adopted the quantitative research method by employing survey questionnaire to collect the data. To collect data, 168 questionnaires are distributed among CEO/managers and assistant managers of 84 institutional members of Nepal Herbs and Herbal Products Association. However, only 164 responses have been received and 161 questionnaires are found useful for the study. For analyzing and generalizing the findings, frequency, mean, standard deviation, correlation and regression analysis have been applied. The findings show that the autonomy, pro-activeness, and innovativeness of EO dimensions are significant to the organizational corruption, whereas risk-taking and competitive aggressiveness is found not significant. The whole study is seen through the lens of Principal-Agent Theory.

Key-words: entrepreneurship, herbs, enterprises, organizational corruption.

PG-O 09

Positive Discrimination in Participatory Forest Management: A Case Study from Community Forest of Lamjung District, Nepal

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Abstract

Despite of great economic and livelihood potential of community forests of Nepal, a small contribution is realized by poor, marginalized and women members. This is mainly due to the dominance of elites in benefit sharing and decision making mechanisms as raised by concerned organizations. This study was carried to determine the overall status of positive discrimination in benefit sharing and decision making mechanism in participatory forest management. Data were collected by using household interviews, focus group discussion and review of policy documents. The data was analyzed by using descriptive and inferential statistics with non-parametric test for different socio-economic/demographic variables. The CFUG has a good source of income Rs. 1,516,650 annually through timber trade. A large amount of CFUG fund (67.07%) was invested in infrastructure and community development. The timber distribution system is based on equity basis. Per unit cost of timber is lower for poor than the rich. The fuel wood, non-timber forest products are free of cost for all users. Positive discrimination found out in the provision of at least 33% of female members in executive committee, distribution of timber at free of cost for the user whose house have been damaged by fire, distribution of timber at low cost or free of cost for poor user, provision of small fund for football player, Dalit users and workers in irrigation canal.

Key-words: Community forestry, disadvantaged group, equity, power, Nepal.

PG-O 10

Inventory Based Management Plans in Nepal's Community Forests: Contributions to Environmental Outcomes

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Abstract

Nepal's forestry legislation requires community forestry user groups to prepare inventory-based management plans for sustainable forest management. Several studies have observed positive changes in forest cover after establishment of community forestry. However, the role of management plans in bringing about such change has not been examined much. Based on case studies in nine community forests in the mid-hills of Nepal, this paper assessed changes in forest conditions and discussed the role of management plans in causing the observed changes. A highly sophisticated Object Based Image Analysis (OBIA) technique was used to assess forest condition, before (2000) and after (2016) images were used in estimating change. In addition, a review of management plans, observation of forest management activities, a household survey and interviews with executive committee members were used as a basis for the study. Image analysis showed that forest conditions have improved after enforcement of inventory-based management plan. However, the improvement cannot be attributed to the management plans only as the silvicultural activities described in the plans were not properly implemented. Instead executive committee specified their own rules and enforced strict protection measures to counteract disturbances such as fire, grazing and illicit harvesting, even if they contradict with the provisions of the plan. In fact, strong enforcement of protection rules introduced through decisions made by executive committees or general assemblies appear to be one of the main reasons for increasing forest cover. This questions the role and need for inventory-based forest management plans with silvicultural prescriptions in community forests.

Key-words: remote sensing, silviculture, forest cover change, community forest.

PG-O 11

**Analysis of Making Decision on Revenue Collection and
Benefit Distribution in Collaborative Forest:
Evidences from Nepal's Terai**

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Abstract

Collaborative forest management (CFM) is one of the innovative large track forest block management model practiced in Nepal's Terai since 2004. CFM is targeted to improve the efficiency of forest management, make it equitable in the distribution of the benefits; the institutional aspects like making the decision, revenue collection, redistribution, are yet to be explored. The study provides the new insights into the collection and redistribution of the benefits from CFM at the local level. The data were generated using household survey ($n = 603$) and focus group discussions with eight groups at CFM area of Bara district. Result reveals that, on an average, 64% of respondents know about the forest revenue. The decision of revenue collection and redistribution is done by user committee where 54.47% respondents said that government forestry institution officials are influencing. The CFM user groups collected NPR 13.43 million from the share of timber, firewood and other sources in last year. Two-third respondents noted that they are getting some benefits, the local government is found ineffective in collecting the bulk share of the revenue from CFM. This has clear impacts on redistribution of the benefits to local forest users. On the other hand, the distance users are not receiving fair share of the benefit mainly because the depots are not reactivated. Nowadays, the user groups have started to disseminate their decision through different grievance redress mechanisms, such as public audit and media mobilization. The study concludes that needy users are not getting benefits from the way of the decision of forest products pricing of CFM are made both in collection and redistribution of the forest revenue.

Key-words: household, forest revenue, user groups, distance user, Nepal.

PG-O 12

**Bureaucratic Re-Centralization Tactics and Counter Tactics
in Nepal's Community Forestry Sector**

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Abstract

Forest decentralization means that centralized forest administrations lose powers over the national forest estate. Field-level forest bureaucrats' rent-seeking opportunities get curtailed as rural peoples', de facto, but formally illegal extraction of forest products becomes legal. However, the forest bureaucracy in Nepal has from the very outset of community forestry in the early 1990s managed to reclaim powers over community forest resources and tap revenue flows associated with the extraction of timber and non-timber forest products for commercial purposes. Based on community forest case studies, literature review, and key informant interviews, including former top-officers from the forest bureaucracy and the Commission of Investigation into Abuse of Authority (CIAA), the paper traces the historical development of forest decentralisation, re-centralisation, and counter re-centralisation. It reveals a pattern of scientific and legal-sounding arguments that have been used instrumentally in reintroducing bureaucratic control over community forest resources while also allowing the forest bureaucracy to extract unofficial revenues from the flow of forest products to the market. One would expect that such concentration of unofficial and hence unaccountable powers would lead to overharvesting of community forests and gross underpayment to forest user groups. Almost the exact opposite is the case. This 'happy paradox', from which other countries with forest decentralisation programmes might learn a lot, includes two main events. First, the intervention of the national Commission of Investigation into Abuse of Authority (CIAA) into the community forestry sector. Second, the Ministry of Forest and Soil Conservation's active intervention in the price-setting of community forestry timber.

Theme 4: Livelihoods

(Oral presentation)

L-O 01

Climate Change and Livelihoods of the Small Holders in Nepal

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Abstract

Nepal is one of the most climate vulnerable countries in the world. Small holder farmers are the ones who are directly facing the impacts of climate change. With review of 3 Local Adaptation Plans for Action (LAPA) one each from Kaski, Chitwan and Banke of Nepal and their implementation status, this paper highlights key impacts and challenges faced by the small holders and any options they have adopted in response to such impacts. Both too much and too low water caused by climate change has been impacting production in their farm. Uncertainty in rainfall, increasing drought, floods, pest and insects and invasive species are some of the climatic impacts that has hindered the production. Diversification of crops and other income sources; use of plastic tunnels and water efficient technologies like drip irrigation, and safety-nets measures like insurance are some of the options to enhance climate resilient livelihoods of the small holders.

Key-words: climate change, livelihoods, Nepal.

L-O 02

Harvesting, Socio-Economic Contribution and Conservation of *Ophiocordyceps sinensis* and Other MAPs in Upper Chameliya Valley, Darchula, Nepal

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Abstract

Ophiocordyceps sinensis is one of the most expensive biological commodities in the world. Its availability in the alpine pasture has become boon to the rural community because of its high trade demand and incomparable economic return. *O. sinensis* appears to be a major part of economic subsistence of local people. We carried out a study in Upper Chameliya Valley in Api-Nampa Conservation Area, Darchula district, north-west Nepal, to find out the availability, harvesting trend and economic contribution to the local livelihood of *O. sinensis* and other medicinal and aromatic plants (MAPs). The study is based on participatory discussions, key-informant surveys, forest walk, and open-ended interviews with primary collectors ($n = 80$) and MAP traders ($n = 7$). Average annual harvest amount of *O. sinensis* over the last five years (2012-2016) was found to be 247 kg (77-405 kg) worth NRs. 285.89 million, representing 86.09% of total value of MAP trade. The individual collection was decreased from 60.7 g in 2012 to 38.7 g in 2016. The local people showed concerns about changes in the availability of *O. sinensis* because of increased number of harvesters and unsustainable harvesting practices. Besides *O. sinensis*, *Fritillaria cirrhosa* and *Neopicrorhiza scrophulariiflora* were the major MAPs in terms of economic contribution. The decrease in the availability of *O. sinensis* has affected the economy of local people and calls for its conservation. On the other hand, this might also lead to the frustration of harvesters and guide over harvesting of other available MAPs as a compensation to *O. sinensis*.

Key-words: Api-Nampa, West Nepal, *Ophiocordyceps*, MAPs, trade, sustainability

L-O 03

Solar-Powered Fence for Mitigating Human Elephant Conflict and Contributing Local Livelihoods in Jhapa District, Nepal

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Abstract

Human Elephant Conflict (HEC) is a complex interaction between human and elephant that represents the detrimental impact for both. This study was aimed to assess the effectiveness of 17 km solar-powered electric fence installed in 2015 in northeastern part of Jhapa district (Bahundangi VDC) against transboundary herds of wild elephants (150-200) that annually entered into Nepal from India. For this study, the detailed information on HEC before and after the fence installation was collected. Based on the official records of district forest office, affected wards within Bahundangi VDC were purposively selected for households survey (N=100), consultations and group discussions (N=5) and participatory field observations. My study showed that during the 5 years (2010-2015), there were 3 human casualties, 6 serious injuries and 2 minor injuries by the attack of transboundary elephants in the study area. Also, there were 8 retaliatory killings of elephants. The most raided crop was paddy followed by maize. The estimated economic loss per household per year in the VDC was NRs. 10,471 (103 USD; crop = 95 USD and property = 8 USD). After the fence installation, only few male elephants accidentally entered in some areas by breaking the solar fence. However, there were no any incidents of human injuries and deaths. Remarkably, there was reduction in economic loss of crop and property damage by 93% and 96% respectively. Thus, solar fence was found to be effective in reducing HEC and finally contributing to livelihoods of local people by protecting their lives, crops and properties.

Key-words: solar-powered fence, livelihood, HEC, transboundary, retaliatory.

L-O 04

Adaptation and Recovery after the 2015 Nepal Earthquakes: A Smallholder Household Perspective

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Abstract

Natural disasters are pervasive and affect human populations dramatically but asymmetrically. Communities reliant on subsistence production are typically more vulnerable than others to disasters such as earthquakes. We study the earthquakes that struck Nepal in the spring of 2015 to assess their multi-dimensional impacts on smallholder communities, and to examine the extent to which the impacts and capacities to recover were heterogeneous across farm households. We focus on a one-year time span post-earthquake because this is when households are still devastated yet beginning to adapt. We use survey questionnaires and open-ended interviews to assess physical impacts to farming systems and cropping cycles. We augment these with subjective assessments of loss and recovery through a new assessment tool, recognizing that people's perceptions of recovery are central to their well-being. We find widespread damage to subsistence agricultural practices and widely different perceptions of trajectories of recovery. Diversification of livelihoods and common resources, alongside robust community institutions, were critical components of coping and recovery. We find that the earthquake has accelerated ongoing transitions to cash crop adoption, and that even within the generally vulnerable smallholder group, there is significant heterogeneity in post-disaster coping and recovery capacity. The notion of recovery is subjective and may not reflect tangible metrics of well-being. Thus we problematize the tacit assumptions behind resilience as a concept: the most economically insecure household may feel “resilient”, at least temporarily, while a more secure and well-connected family remains well below its pre-disaster level of perceived security.

Key-words: disaster, communities, recovery, diversification, resilient.

L-O 05

Assessment of Post-Earthquake Water Poverty Index: A Case Study of Thulosirubari VDC, Sindhupalchowk

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Abstract

On 25 April 2015, at 11:56 local time, devastating earthquake of about 7.8 magnitude struck Nepal affecting 31 districts. Sindhupalchowk is one of the worst-affected districts where 1497 Male and 1943 Female lost their life and 4058 people were injured. Water, a life-sustaining and dynamic element, can become the major concern after a disaster and of course recent earthquake exaggerated the water poverty. This study made an attempt to assess the impact of earthquake on water resources infrastructure and construct post-earthquake water poverty index of Thulosirubari VDC using five components Resources, Access, Capacity, Use and Environment with eleven indicators and fourteen variables. Focus Group Discussion at ward level was the major source of information to assess the water poverty at the VDC level. Study shows that earthquake has severe impact on water resource related infrastructure in all the wards of the VDC, pipe line and water storage tank of the community water supply system and irrigation canal were damaged affecting every corner of the society. They were deprived of drinking water facility for more than two week and even during research period people were forced to travel longer distance to manage water for the household use. The study results show that Water Poverty Index (WPI) is 40.78, where Resource (R)=69, Access (A)=36, Capacity (C)=44, Use (U)=27, Environment (E) =27.6 respectively which is relatively worse compared to national level (54.4). Analysis of the WPI components in the VDC shows somewhat higher values of resources and capacity compared to access, use and environment.

Key-words: earthquake, water, water poverty, Sindhupalchowk.

L-O 06

Contribution of Agroforestry on Rural Livelihoods in Nepal

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Abstract

Agroforestry practices are quite popular in the mid hill region of Nepal. However, the contribution of agroforestry practices on enhancing the livelihood of local communities are less examined. This study examines the contribution of agroforestry in rural livelihoods of the Kaski district of Nepal. The study identified two types of the agroforestry practices, traditional (sub-subsistence) and improved (commercial). From each category, 70 households were selected randomly for an interview, focusing on fodder and fuel wood availability, household income, especially from the agroforestry practices, capacity to cope with climatic shocks and stresses, and food security. Nearly nine-tenth of the households were collecting fodder and firewood, which remained almost similar in both practices. However, traditional agroforestry system supplied more firewood compared to improved farming. Nevertheless, the supply of grasses and fodders remained similar in both practices. As a result, people are rearing livestock, especially for selling milk and goat. Each household generated an annual income of NRs 32,400 from the practices, which is about one tenth of the total household income. The contribution to households' income is relatively higher in improved practices. The households perceived that agroforestry is contributing to improve food security, creating employment opportunities and enhanced capacity to cope with shocks and stresses. The study concludes that contribution to rural livelihoods of the improved practices is quite high. Hence, such practices should be further promoted and strengthened.

Key-word: Rural, traditional, livelihood, income.

L-0 07

Growth Performance of Domesticated *Swertia chirayita* and its Contribution in Rural Income in Langtang National Park, Rasuwa Nepal

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Abstract

The northern part of Rasuwa district in Nepal is remote and the major livelihood is agriculture, supplemented by non-timber forest products collection. Presently, *Swertia chirayita* cultivation is attractive income generation business. However, the growth of the plant, nutrient levels and economic analysis of the cultivation of this species has not been done before. Thus, this study was objectively carried out to explore the growth performance of *S. chirayita* and to explore its contribution to rural income. Syafru Village of Rasuwa district was selected as study site. Altogether, 12 farmers, who had cultivated this species in their farm, were randomly selected applying complete random design. Altogether, 50 samples having 2×2 m² area were taken from the farmers' field. The collar diameter at 15 cm and height of the plant were measured. In addition, fifty soil samples were collected from 0-10 cm depth. Soil samples were analyzed to find N, P and K contents, pH, and B/C ratio. NPV was calculated to evaluate the income. The results showed that the height of *S. chirayita* ranged 112-154 cm, with the mean height of 135.01 cm. The mean collar diameter was 2.4 cm. *S. chirayita* prefers acidic soil (mean pH 5.7). The mean value of N, P, K was 0.27%, 39.39 kg/ha and 791.42 kg/ha, respectively. Carbon quantity available in soil was 2.84%. The benefit cost ratio was 2.12 (range: 1.53 and 2.72). The NPV of mean income of the farmer was NRs. 264730.43. The study reveals that farming *S. chirayita* in unused farmland and barren land would be good opportunity to generate income for uplifting people's livelihood.

Key-words: collar diameter, benefit cost ratio, *Swertia chirayita*, livelihood.

L-O 08

Trend of Climatic Variables and Impacts on Yield of Finger Millet in Chitwan-Annapurna Landscape, Nepal

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Abstract

Agriculture is main source of economy in Nepal and depends on natural conditions. The yield of crops mainly depends on climatic factors to a greater extend of mountainous country like Nepal where. Conceivable situation of climate change like rise in temperature and change in pattern of rainfall in an area will unswervingly influence crop yield. This study analyzed the change on total harvestable area, yearly yield and effects of changing climatic variables on yield based on linear regression analysis for historical (1980-2016) climatic data and field data of yield for finger millet in CHAL. The harvestable area and yield growth rate of finger millet is positive ($P<0.00$) with time. Growing season temperature and rainfall shows influence in yields of finger millet. Trends of growing season temperature in study area is significant ($P<0.00$) with time i.e. increasing order of yield and rainfall in decreasing order in all districts. Linear regression analysis shows that 100 percent of districts have direct influence of rainfall on yield and 50 percent districts of influence is due to rise in temperature. Although rainfall is at declining trend in almost all districts in growing season, but increasing trends in temperature has positively contributed to the yield of finger millet growth in CHAL.

Key-words: growing season, harvestable, climate change, districts.

L-O 09

Impact of Modernization on Sustainable Livelihood Strategies of Indigenous People in Kathmandu: A Study of Maharjan (Jyapu) of Newars

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Abstract

Indigenous people are well known for sustainable use of environmental resources which not only enhance their livelihood and well-being but also contribute towards mitigation of global environmental issues. Their traditional resource management practices and techniques are believed to bring a balance between livelihood enhancement and conservation of natural environment contributing to well-being of present as well as future generations. However, development of indigenous people through the traditional practices has been a challenge. Therefore, modernization is considered to provide better opportunities for livelihood both in urban and rural settings. Till date, modern practices have almost replaced indigenous practices of livelihood enhancement and well-being but they have ignored conservation of earth's resources, socio-cultural concerns creating alarming environmental problems. They have also created a frightening vulnerability of sustainable livelihood and well-being of indigenous groups around the world. Nepal provides a suitable context for investigating the above mentioned issues because it is a home for more than 59 indigenous groups. This paper studies the sustainable livelihood strategies of Maharjan (Jyapu) of Newars of Kathmandu, Bhaktapur and Lalitpur districts before and after the modernization. The qualitative findings generated through life stories will reveal issues in the sustainable development of the people, nature and culture in the community. This study will have policy and strategic implications for inducing sustainable development of the community and environment.

Key-words: sustainable livelihood practices, environment friendly practices, indigenous communities, Newar and Jyapu.

L-O 10

Biomass Production of Medicinal Plants in a Tree Intercropping System for Livelihood

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Abstract

Root yield of medicinal plants, *Rauvolfia serpentina* and *Withania somnifera* and above ground biomass of *Ocimum basilicum* under intercropping system with trees combination, like *Leucaena leucocephala*, *Melia azedarach* and *Morus alba* was investigated in Terai Mumta Woman Community Forest of Rautahat district without irrigation and fertilizer use. The experiments were laid out in 3 × 3 split plot designed with 9 treatments and 4 replications. Tree species were planted in 3 × 3 meter and medicinal plants in 0.5 × 0.5 meter spacing. Biomass yields were recorded after harvesting *Rauvolfia serpentina*, *Withania somnifera* and *Ocimum basilicum* after 16, 6 and 3 months respectively. The root yield of intercropping *Leucaena leucocephala* × *Rauvolfia serpentina* was 189.44 q/ha, *Melia azedarach* × *Rauvolfia serpentina* 181.12 q/ha, *Morus alba* × *Rauvolfia serpentina* 174.4 q/ha, *Leucaena leucocephala* × *Withania somnifera* 6.76 q/ha, *Melia azedarach* × *Withania somnifera* 6.36 q/ha and *Morus alba* × *Withania somnifera* 6.52 q/ha. Likewise, the above ground total biomass of *Leucaena leucocephala* was determined 216.48 q/ha in an intercropping with *Ocimum basilicum*, *Melia azedarach* 192.12 q/ha with *Ocimum basilicum* and *Morus alba* 180.12 q/ha with *Ocimum basilicum*. The result of the research showed the root yield of *Rauvolfia serpentina* and *Withania somnifera* as well as above ground biomass of *Ocimum basilicum* was highest with *Leucaena leucocephala* and lowest with *Morus alba* combination. Economic analysis supported income generation from the medicinal plants to the poor farmers.

Key-words: biomass, root yield, production, medicinal plants, intercropping, income, livelihood.

L-O 11

Wild Edible and Medicinal Plants for Livelihood of Raji Indigenous People in Western Nepal

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Abstract

The Rajis are one of the endangered indigenous people of Nepal distributed in mid- to far-western Nepal. As the livelihood of Rajis is dependent on traditional means of survival, such as fishing, hunting and gathering forest products, a study was carried out in Surkhet and Kailali districts of Nepal to understand utilization practices of forest products, especially wild edible and medicinal plants. A total of 129 species of plants, belonging to 61 families, were identified as being important to the livelihoods of Rajis for food and medicine. Twenty four species were identified as wild food, 51 species as medicinal and 52 species as both food and medicine. The medicinal plants used by Rajis were effective to treat about 77 types of health disorders. There is impact of modernization, urbanization and social transformation on the livelihood of Raji people in one hand and on the other habitat destruction and people's migration have negative impacts on the traditional practices. However, the elderly people are highly knowledgeable and have not abandoned traditional utilization of wild edible and medicinal plants for livelihood.

Key-words: Raji, traditional knowledge, livelihood, medicinal plants, edible plants.

L-O 12

Isolation of Bioactive Chemical Compounds from Wild Harvested High Altitude Plant, *Anisodus luridus* and Its Local Uses in Nepal

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Abstract

A large proportion of the rural population living in the Himalayan region depend on plant resources for food, nutrition, fodder, medicine, condiment, dye and other useful materials. Medicinal plants have served people as the means of curing diseases since time immemorial. *Anisodus luridus* (Family Solanaceae) is one of the important commercial medicinal plants having variety of local uses. Some bioactive chemical compounds were isolated from the wild harvested leaves of this plant by means of systematic fractionation and chromatographic resolution of n-hexane extract and methanolic extract. n-hexane extract yielded three compounds, viz., triterpenoid ester, β -sitosterol and steroidal glucoside. Similarly, methanolic extract yielded six flavonoids, apigenin (IV), luteolin (V), quercetin (VI), quercetin-3-O- α -D-rhamnoside (VII), kaempferol-3-O- α -rhamnoside (III), Quercetin-3-O- α -D-glucopyranosyl-O-rhamnopyranoside (IX). The compounds were characterized on the basis of their physico-chemical analysis and chemical degradation studies. All the above bioactive compounds are used to cure different diseases. The local uses of the plants in high altitude Himalayas were also explored. Locally, the plant is used in curing wounds, abdominal problems, parkinson diseases, and as an intoxicating drug besides fodder use particularly in the winter to decold animals by local healers and Baidyas.

Key-words: *Anisodus luridus*, high altitude, Himalayan medicinal plant, bioactive compounds, diseases, local uses.

L-O 13

Uncovering Livelihood Strategies, Activities and the Process of Domestication of Chiraito (*Swertia chirayita*) and Satuwa (*Paris polyphylla*), Two Cultivated NTFPS in the Hills of Taplejung, Nepal

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Abstract

The process that households undergo from wild plant to cultivated field species is undescribed as a livelihood activity in rural Nepal. Literature suggests that analyzing the potential of non-timber forest products (NTFP) for poverty alleviation and conservation of natural resources requires a sustainable livelihood approach. Analyzing domestication as a livelihood activity facilitates the understanding of the dynamic character of this process and thus contributes to the growing body of literature that tries to uncover the potential of the NTFP medicinal plants for Nepalese farmers. This study proposes to understand the activities in which households engage when domesticating important commercial NTFPs, their context, and the outcomes of domestication on rural livelihoods in Nepal. For this, the collection and cultivation activities of two, the mainly collected satuwa (*Paris polyphylla*) and the more cultivated chiraito (*Swertia chirayita*) were compared. In a mixed method approach the income strategies and livelihood contexts of 115 satuwa and chiraito collectors and cultivators were observed and analyzed. The sustainable livelihood framework was combined with the economic model of domestication by Homma (1996) and the process of forest management practices by Wiersum (1997). Outcomes indicate that satuwa and chiraito are currently part of small-scale farmers' income diversification strategy. Peaks in demand are likely to create periods of intensification and cultivation activities by farmers. Traders and organizations play a substantial role in transmitting information on cultivation and the process finds support in

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development approaches. But economic losses of chiraito yield by large-scale cultivators and strong price fluctuations, coupled to a demand difficult to estimate lead to the conclusion that satuwa and chiraito are most effective as diversification and not intensification of income sources. Both medicinal plants require low input for cultivation and are thus very relevant to poor households' cash incomes and used as such for subsistence and safety net.

Key-words: domestication, medicinal plants, rural livelihoods, NTFP, livelihood strategies.

L-O 14

Minor and Underutilized Fruit Diversities in Nepal: Strategies for Conservation and Utilization for Livelihood Improvement for Small Holder Farmers

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Abstract

Diverse genetic resources base of fruits in Nepal is contributed by wild, indigenous, minor and underutilized plants. The wild and underutilized fruits harvested from forests and farmers' marginal lands can be seen in many local markets. Many of these minor fruits perform better than exotic species. Fruits, such as kafal (*Myrica esculenta*), lapsi (*Choerospondias axillaries*) and amala (*Emblia officinalis*) harvested from forest are sold in local markets which generate a considerable amount of income to the small holder farmers. Fruits like pummelo (*Citrus maxima*), citron (*Citrus medica*), and walnut (*Juglans regia*) are used during special rituals, such as for *Bhaitika* in *Tihar* and are sold during those festivals. Likewise, bael (*Aegle marmelos*) is used by *Newari* community during the *Bael Bibah* of their daughters. All these fruit germplasms are being maintained in field since other methods have not yet been developed. A National Genetic Resource Centre (NGRC) including major and minor fruit germplasms repository should be established to utilize them. There should be provisions of freeze preservation and cryopreservation, *in vitro* as well as a field gene banks. The TRIPs agreement has provision of protecting plant varieties either through plant patents or an effective *sui generis* system or a combination of both. Development and implementation of TRIPs system to protect indigenous and underutilized fruits should be focused. *In-situ* evaluation of these genotypes using a common protocol could be a worth at initial step whether they are under public or private description.

Key-words: Fruit diversity, indigenous, conservation, preservation, utilization, strategy, livelihood

L-O 15

Do the Methods Matter? Comparing Intra-Household versus Household Level Approach to Quantifying Income in Nepal

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Abstract

Lack of studies comparing household's income at household and intra-household level means that there is scant/no evidence on the differences in income estimates when using household and individual as a unit of analysis across different sources of income. This study tests the hypothesis that household head cannot provide an accurate estimation of the environmental income of the individual household members while for the wage income interviewing only the household head can provide an accurate estimation of the income of other adult household members. To investigate whether the data yield significantly different estimates of income across different data collection instruments, a total of 328 (78 household heads and 250 individual) respondents from randomly sampled household were interviewed from Chainpur VDC of Chitwan district in Nepal. The result presents that absolute mean environmental income dropped from USD 64.94 to USD 21.53 while wage income increased from 30.82 USD to 188.14 USD across the five years period (2012 and 2017). In 91.01 percent of household, the household head tends to significantly underestimate and overestimate the household's total environmental income. In contrast, in 78.2 percent of households, wage income estimates are in line when using the household and the individual as the unit of analysis. Such significant difference in environmental income when household head accounts for other household member income can have implication on our understanding of the prevalence of poverty and income equalizing effects of the forest and non-forest income.

Key-words: household income surveys, forest, wage, environmental income.

L-O 16

Use of Wild Food Products and its Importance in Livelihood (A Case Study of Protected Areas of Nepal)

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Abstract

Shivapuri National Park and Parsa Wildlife Reserve were selected for the study. The study was based on Ph.D. dissertation “Use of Wild Food Products in Relation to Household Food Security in Nepal from Gender Perspective” in 2011. The research was done in the buffer zone where crop depredation by wild animals was prominent and directly effect to livelihood. The main objective of this study is to explore the role of forest resources in ensuring household food security and income generation. Livelihood was one of the great problems in buffer zone where crop damage by wildlife was very common, especially among poor and land less people. It was found that different strategies like fuel wood selling, alcohol making by using fuel wood and timber smuggling as alternative livelihood measures were adopted. It affects conservation threat for sustainability. It was found that food security of PAs was 56.6% from agriculture and other sources of income. Migrated people had more food security (51%) than indigenous people (24%). It was found that wild food contributes 2.5% (25 g/day/person) total foodstuff which was projected as 43 kg per year. The annual estimated consumption of wild food was significantly different among indigenous and migrated people. Different products were collected from park forests, community forest and fallow land. The major wild food collectors were women.

Key-words: wild food, protected area, buffer zone, indigenous people, fellow land, livelihood.

L-O 17

Investment and Benefits Associated With Community-Based Forest Enterprises in Nepal

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Abstract

Community forests in Nepal are operating various types of forest-based enterprises. These enterprises are generating considerable amount of income and employment at the local level. Comprehensive assessment of these enterprises is needed to improve their condition in the future which is currently lacking in Nepal. To fulfill this gap, we collected data from 195 community-based enterprises of 23 districts of Nepal representing all geographic and development regions. For analysis purpose, we categorized the enterprises into four categories, *viz.* non-timber forest product (NTFP), timber, ecotourism and animal husbandry enterprise (AHE). We analyzed the investment, income, beneficiary households and employment generation from these enterprises and compared them with each other. Analysis of variance (ANOVA) was carried out to test the mean significance difference between different enterprise categories. Mean investment in ecotourism (NRs. 2371729) and timber-based enterprises (NRs. 1170252) was found to be higher than the mean investment in NTFP (NRs. 273315) and AHE (NRS 351896). Mean income from the enterprises was NRs. 206186 per year and found significantly different between the types of enterprises ($p < 0.05$). On an average, 127 households have been benefitting from one enterprise. The mean employment generation (2527 man days) from timber-based enterprises was the highest, followed by ecotourism enterprises (1490 man days). The mean employment generation from NTFP (1093 man days) and AHE (978 man-days) is found significantly lower ($p < 0.05$) than timber- and ecotourism-based enterprises. Examination of factors associated with success or failure of community-based forest enterprises is recommended for future researchers.

Key-words: income, employment, ecotourism, community forestry.

L-O 18

Traditional Knowledge of Tamang Community on Plant Resources for Improving Their Livelihood in Kavrepalanchowk and Dhading Districts

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Abstract

Traditional knowledge studies help for conservation of cultural tradition, sustainable use of plants as well as for socio-economic growth of the ethnic communities. The present work documents 110 plant species belonging to 100 genera of 60 families used by Tamang community of Ryale and Pokhari Narayansthan Village Development Committees (VDCs) of Kavrepalanchowk district and Dhunibesi Municipality of Dhading district. The research was conducted in 2015 and 2016. Primary data was collected through semi-structured interviews and group discussions. The information collected include local name, form of use, parts used and uses. Forty plant species were used for medicinal purpose, 42 used as fodder and fruits of 29 plant species were found edible. Other uses included firewood, timber and veterinary use. This study concludes that Tamang community of both sites have been using plant resources since the past and are still dependent on it, apart from using modern medicines and modern agricultural practices. Hence, this community had good traditional knowledge on using wild plants to support their livelihood. Documentation of traditional knowledge of local and ethnic communities is necessary before the knowledgeable generation gets completely lost.

Key-words: traditional knowledge, Tamang, plant resources, livelihoods.

Livelihoods (Poster)

L-P 01

Status of Invasive Alien Plant Species in Community Managed Forests: A Case of Sundari and Dhuseri Community Forests of Nawalparasi District, Central Nepal

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Abstract

Biological invasion has posed serious threats upon the ecosystems all over the world. The invasive alien plant species (IAPS) have been reported to have a number of impacts including reduction in forest regeneration, change in species composition, and increased frequencies of fire. Forests are considered to be less prone to invasion by IAPS than other ecosystems, particularly when canopy cover is high. To understand the status of IAPS in community managed sal (*Shorea robusta*) forests, an inventory was undertaken in two community-managed forests (Sundari and Dhuseri) of Nawalparasi district. Sampling was conducted to list the IAPS, and their abundance in forest edge, gaps and within canopy. Focus group discussion, key informants interview and individual household survey were used to understand the impacts of IAPS on livelihood and local perception on the dynamics of IAPS. The studied forests had 14 species of IAPS. Among them, *Chromolaena odorata*, *Ageratum houstonianum* and *Lantana camara* were considered as problematic for local communities. *Chromolaena odorata* was the most frequent IAPS in both the forests; however, it was present as a minor component in the high canopy stands while it was a dominant component in canopy gap and forest edges. The cover of IAPS was higher at forest edge and gap than in the interior (within canopy). The IAPS richness and cover declined with increasing tree canopy cover and basal area. Therefore, improvement in the condition of forest leading to increased canopy by community management can suppress the IAPS.

Key-words: forest edge, forest gap, vegetation sampling, circular plot, species richness.

L-P 02

Forest Seeds – A Bonus for Livelihood of Forest-Dependent Communities

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Abstract

Food and nutritional security are the key concerns the world over. Since ancient civilizations, it has been persistent effort of the mankind to explore new sources of food for humanity. Forests play an important role in many food systems and also are one of the major sources of livelihood for the forest-dependent communities. Non-wood forest products from the forests contribute to seasonal income of communities in times of need through small-scale forest-based enterprises and off-farm rural employment opportunities. Flowers and seeds of various forestry species have been traditionally extracted for food, nutrition, income generation, etc. Species like *Buchanania lanzan* (chironji), *Madhuca longifolia* (mahua), *Emblica officinalis* (aonla), *Terminalia* spp. (harad, bahera), *Shorea robusta* (sal), *Azadirachta indica* (neem), *Garcinia indica*, *Diploknema butyracea* (cheura) and *Pinus gerardiana* (chilgoza) have contributed significantly to tribal and rural income in central, south and northern regions of India. This also at times contributes to diversification of the economy and potentially minimizes the risks associated with any crop and fodder failures due to natural calamities. Seeds of many forestry species like *Pongamia pinnata*, *Prunus armeniaca*, *Sapindus mukorossi*, *Aleurites* spp. are a rich source of oil and butter (tree-borne oilseeds) and are scattered in forest and non-forest areas and their existing potential is not being utilized fully. Seeds of forestry species hold tremendous potential in livelihood support, subsistence economy, which need to be promoted for cultivation and more scientific methods of collection and utilization need to be developed and extended to communities for enhancing their incomes.

Key-words: forest seeds, livelihood, tree-borne oilseeds, tribals, rural community.

L-P 03

**Improvement in Livelihood of Indigenous People
through Collection and Marketing of Wild Vegetables
in Chitwan and Periphery**

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Abstract

Wild vegetables play an important role in the livelihood of indigenous communities, living in eastern region of Chitwan and periphery. Chepang and Rai communities collect wild vegetables from nearby forests and sell their marketed surplus in nearby markets. Survey was conducted at 50 households, 10 traders and 10 consumers in Shaktikhor and Manahari, using semi-structured questionnaire. A total of 4 wild vegetables viz. Wild mushroom, Wild fern, yam and bamboo were collected and marketed by indigenous communities. Major volume of collected product (46%) was marketed through Consumer channel, followed by Retailer- Consumer channel. Similarly, major problem was attack of wild animals (31.25%), followed by policy restrictions (29.68%). The majority of the income from marketing of collected wild vegetables was utilized for food (40%), followed by alcohol (22%). Only 14 % of income was utilized for education. Chitwan has rich wild vegetable resources, which are being used for upliftment of local livelihood. A comprehensive survey indicated that lack of proper collection and marketing have led problem to prioritize wild vegetables as a source of food security.

Key-words: collection, livelihood, marketing, wild vegetables.

L-P 04

Indigenous Knowledge of Beekeeping with *Apis cerana* in Gorkha Districts Nepal

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Abstract

Economically five important honeybee species are recorded in Nepal as *Apis cerana*, *Apis mellifera*, *Apis laboriosa*, *Apis dorsata* and *Apis florea*. Farmers' indigenous knowledge on beekeeping was investigated during survey conducted at Chyangli and Dhuwakot VDCs of Gorkha district, Nepal in 2015. Open-ended questionnaire was used to collect necessary information during survey. In forest areas of Nepal bee colony can be found in hollow tree branches. Farmers search these colonies and domesticate them. Keeping two to three bee hives of *Apis cerana* in a farmer house in traditional log bee hives or in the wall of house with sustainable management practices is common in rural areas. Farmers harvest honey two times in a year, once at March to May and second September to November, by squeezing all the combs. These techniques of beekeeping have been handed from generation to generation since time immemorial. The indigenous knowledge on beekeeping may be applicable in modern beekeeping.

Key-words: honeybee, indigenous knowledge, beekeeping.

L-P 05

Effect of Organic Nutrient Management on Growth, Yield of Beetroot (*Beta vulgaris*) and its Residual Effect on Soil

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Abstract

The present investigation “Effect of Organic Nutrient Management on Growth, Yield of Beetroot (*Beta vulgaris*) and its Residual Effect on Soil” was conducted in Himalayan College of Agricultural Sciences and Technology (HICAST) Integrated Research Farm, Badegaun, Lalitpur from November 2016 to March 2017. The experimented plots were subjected to five treatments viz. FYM (T₁), vermicompost (T₂), poultry manure (T₃), compost (T₄), T₅ control (Farmer's practice). The experiment was laid out in a randomized complete block design with three replications. Data analysis was done through MS-Excel and Genstat. In the study, maximum plant height of beetroot was found to be 18.4 cm, root diameter was 3.16 cm and root weight was 104.1 gm in treatment (T₃) poultry manure. The maximum number of leaves, root length and organic matter was observed in treatment vermicompost (T₂). Similarly, available soil nitrogen (346.2 kg/ha), phosphorous (443 kg/ha) and potassium (144.2 kg/ha) content was observed maximum in treatment (T₃) poultry manure. Optimum soil pH was obtained in compost (T₄). The maximum increase in yield per plot in T₃ (poultry manure) as compared to FYM was 82.25%, followed by vermicompost (65.02%). During research pest outbreaks was minimum. From the findings of this study, it is concluded that poultry manure is the best organic manure for the cultivation of beetroot with least residual effect on the soil, further research are needed to justify the results.

Key-words: beetroot, organic, poultry manure, vermicompost, yield, FYM.

L-P 06

Economics and Performance of Sinhal Goat in Farmers Managed Condition of Mid-Hill Region of Nepal

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Abstract

A study was conducted to find performance of Sinhal goat and overall impact of livestock on livelihood of people of high hills region of Nepal from February 2015 to May 2017. Semi-structured questionnaire were prepared to find preliminary information on Sinhal goat farming. Weight traits of animals were recorded regularly with digital balance on recording book. Data were entered in Microsoft excel and analyzed by R software package R 3.2.4. It was observed that birth weight, one month weight, 3 month weight, 6 month weight, 9 month weight, 1 year weight, 15 month weight, 18 month weight and adult weight of goats were found 2.55 ± 0.019 , 5.28 ± 0.63 , 8.92 ± 0.87 , 12.56 ± 0.134 , 15.63 ± 0.188 , 18.58 ± 1.79 , 21.54 ± 1.74 , 24.25 ± 1.82 and 36.9 ± 4.8 Kg respectively. It was observed that all the growth traits of goats were highly significant ($p < 0.001$) for sex except 9 month weight. There were district wise differences in growth rate in goats but none were significant. In addition, age at first kidding, kidding interval and gestation length was found 645 ± 79.8 , 325.8 ± 44.85 and 149.33 ± 2.71 days respectively. Twinning percentage in Sinhal goat was observed 10% with number of kid per doe per year 1.25. Average number of livestock head per family was observed 162 in numbers in selected household with annual revenue of Rs. 6,82,545 from livestock farming. Livestock is indispensable component of livelihood of high hills region of Nepal that needs promotion and support to alive this business for new generation.

Key words: High hills, semi-structured, significant, twinning, revenue.

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