IPBES-JBF Sub-regional Dialogue Workshop Report

on Indigenous and Local Knowledge (ILK)

for South and West Asia sub-region

(29 November - 2 December 2016, Dhulikhel (Kathmandu), Nepal)

March 2017

Institute for Global Environmental Strategies (IGES)

Tokyo Office, Institute for Global Environmental Strategies (IGES)

Shinbashi SY Bldg. 4F, 1-14-2, Nishi-shinbashi, Minato-ku, Tokyo, 105-0003, Japan
TEL: +81-3-3595-1081 FAX: +81-3-3595-1084
Email: cbdjf@iges.or.jp
URL: http://www.iges.or.jp

IGES is an international research institute conducting practical and innovative research for realising sustainable development in the Asia-Pacific region.

Cover photo credits; Sana Okayasu (Center), Chandra Kanta Subedi (Left),
Tomoshi Ichikawa (Right)
Prepared jointly by IGES, ReCAST-TU, CGED-N and ESON

Editors:

Madhav Karki, Ram Prasad Chaudhary, Krishna Kumar Shrestha, Yoichi Sakurai, Durga Prasad Pandey

Editorial support:

Chandra Kanta Subedi,,Manoj Kumar Mishra, Federico Lopez-Casero, Wataru Suzuki, Sana Okayasu, Tomoshi Ichikawa, Emma Fushimi

---

Acknowledgements

The IPBES-JBF Sub-regional Dialogue Workshop on Indigenous and Local Knowledge (ILK) for South and West Asia sub-region was implemented by IGES as a part of the Capacity Building Project for the implementation of IPBES Asia-Pacific Regional Assessment of the IPBES. This project is supported by the Japan Biodiversity Fund (JBF) funded by the Ministry of the Environment of Japan (MOEJ) through the Secretariat of the Convention on Biological Diversity (SCBD). The IGES would like to thank the Research Centre for Applied Science and Technology (ReCAST), Tribhuvan University (TU), Nepal for their cooperation and support in conducting the workshop and providing editorial advice.

Table of Contents

1. Background, outline and programme of the workshop

1.1 Background

In June 2016, the IPBES ILK Dialogue Workshop for Asia-Pacific regions was held in Chiang Mai, and to follow up the outcome of that workshop in June, this sub-regional dialogue workshop for South and West Asia was planned. In the preparatory stages, a call for submissions was issued through the IGES website, and the organisation committee of the South and West Asia sub-region comprising of the IGES, ILK Task Force member cum Co-chair of the IPBES AP Regional Assessment and ReCAST/ CGED/ ESON carefully evaluated and selected the participants for this workshop. The Research Centre for Applied Science and Technology (ReCAST), Tribhuvan University (TU), Nepal as the local host organisation, greatly supported all the activities from the preparation to implementation stages of the workshop. The workshop was held in Dhulikhel (Kathmandu), Nepal from 29 November to 2 December, 2016, and attended by ILK holders, ILK experts and experts on ILK from India, Iran, Nepal, and Pakistan. The Dialogue workshop was preceded by an interactive session with the local ILK community and followed by a site visit. Overall the workshop accomplished its objectives with great success.

1.2 Objectives

The main objective of the workshop was converting the stories shared by ILK holders at the Chiang Mai Asia-Pacific regional dialogue into validated papers to be published as reference materials for the AP assessment report. The workshop also made efforts to identify additional cases and stories to fill in the gaps in terms of regional and thematic balance as well as to further develop the shared stories at the Chiang Mai Asia-Pacific regional dialogue.

The specific objectives include to:

- Follow up the outcome of the IPBES ILK Dialogue Workshop for Asia-Pacific in Chiang Mai 2016 for the sub-regions for South and West Asia.
- Build relationships, respect mutual understanding and trust between and among ILK holders, ILK experts, assessment authors, and Taskforce members.

- Enhance capacity and empowerment of ILK holders, ILK experts and assessment authors to meaningfully and effectively participate in the Asia-Pacific Regional Assessment (APRA).
- Provide support to indigenous peoples and local communities' for their contributions to conservation and sustainable use of biodiversity.
- Facilitate the processes of identifying sub-regional hubs, nodes and focal points for ILK.

1.3 Expected outputs

- Discussion on the possible reflection of ILK into the Asia-Pacific Regional Assessment (APRA) and suggested text to be added to the assessment reports.
- Identify further ILK holders and develop a list of ILK holders in each sub-region, and also identify priority ILK literatures, as necessary.
- Additional proceedings, discussion summary and meeting report to be referred by authors for APRA.
- Develop a list of ILK resources, ILK holders, and hubs, nodes and/or focal points in the South and West Asia sub-region for developing a sub-regional ILK Network.

1.4 Organising structure and key partners

In order to prepare the plan and implement this Sub-regional Workshop, the "Organisation Committee for the Sub-regional Dialogue Workshop on ILK for South and West Asia" was formed. The members of the Organisation Committee are listed below in the table.

Organisation Committee for the Sub-regional Dialogue Workshop on ILK for South and West Asia

Name	Affiliation	Role
Madhav Karki	Co-chair, APRA; ILK TF member, Executive Director, CGED-Nepal	Facilitator/Co-host
Ram P. Chaudhary	Professor Emeritus, ReCAST, TU	Host /Co-organiser
Krishna K. Shrestha	President, Ethnobotanical Society of Nepal (ESON)	Co-Host

Durga P. Pandey	Executive Director, ReCAST, TU	Co-Host
Yoichi Sakurai	IGES JBF Project team	Sponsor/Organiser
Wataru Suzuki	IPBES-TSU-AP	AP Technical Support Unit (TSU)

An advisory cum organisation committee for smooth planning and implementation of all the three Sub-regional Workshops in Asia-Pacific region including this South and West Asia Sub-regional Workshop, was formed. The members of the Advisory Committee are listed below.

Advisory Committee for the Sub-regional workshops in Asia-Pacific

Name	Affiliation	Role	Remarks
Madhav Karki	Co-chair and TF member	Facilitator	S & W Asia
Ro Hill	TF Member	Facilitator	Pacific
Doug Nakashima	IPBES-TSU-ILK	Advisor	
Joji Carino	Resource person	Advisor	
Thomas Koetz	IPBES Secretariat	Advisor	
Simone Schiele	IPBES Secretariat	Advisor	
Wifredo V. Alangui	TF Member	Facilitator	SE & NE Asia
Dayuan Xue	TF member	Facilitator	SE & NE Asia
Kaoru Ichikawa	TF member	Facilitator	SE & NE Asia

For the South/West Asia Sub-regional dialogue workshop, an “Advisory Committee for the Sub-regional workshop” was set up as described above. Furthermore, the Research Centre for Applied Science and Technology (ReCAST) undertook the main and significant role of the local host organisation for preparing and implementing this Sub-regional Workshop in collaboration with IGES, CGED-Nepal and ESON.

1.5 Workshop Programme

Day 0: 29 November 2016 (Tuesday)

12:00-	Preparatory meeting of the Organisation Committee, IGES and ReCAST
14:00-	Dialogue with local host organisations including their network partners; Coordinator: FECOFUN, Kabhre, District
17:00-	Organisation Committee Meeting

Day 1: 30 November 2016 (Wednesday)

8:30-9:00	Registration, tea and coffee, mingling
9:00	Inauguration (see separate programme below)
10:00	Tea/Coffee break
10:30	Introduction of the objective and programme of the workshop (Speakers: Yoichi Sakurai (JBF Team); Wataru Suzuki (TSU-AP); and Ram P. Chaudhary (ReCAST).
11:00	The summary of the outcome of the Chiang Mai workshop (Speaker: Madhav Karki, member, IPBES ILK Task Force and the Co-chair, IPBES AP Regional Assessment)
11:30	Presentation of additional (new) cases by additional 5 participants selected, followed by discussions (15 minutes each) Pakistan (2 presentations), India (1), and Nepal (2); Q&A and discussions
13:00	Lunch
14:00	**Presentation of the Case studies** (1) Saima Hashim, (2) Muhammad Ibrar Shinwari, (3) Brajesh K. Tiwari, (4) Bijay Raj Subedee, (5) Shiva Devkota, (6) Bahar Mohamadifar, (7) Saeid Nouri Neshat, (8) Robert Panipilla, and (9) Davidson Sargunam Selvanayagam

16:00	Tea/Coffee break
16:30	**Integration between ILK and Modern Science in IPBES Assessment** (joint power point presenters): Madhav Karki (IPBES ILK TF Member), Ram P Chaudhary (IPBES Review Editor), and Krishna K Shrestha (ILK Expert)
17:00	**Continuation of the Presentation of the Case studies** (10) Madhav Karki, (11) Ram Prasad Chaudhary, and (12) Krishna Kumar Shrestha
17:30	1st Day wrap-up Remarks by the facilitator: Madhav Karki

Day 2: 1 December 2016 (Thursday)

8:45	**Continuation of the Presentation of the Case studies** (13) Gopal Dahit Recap of the Day 1 session and introduction of the Day 2 agenda: Integrating different knowledge systems and IPBES assessment oriented paper writing sessions (Madhav Karki)
9:00	Writing session-1: Brief introduction of Chapter 1 and Chapter 2 by the authors and discussion and on how ILK and related cases can be included in the assessment report (Speakers: Madhav Karki (Chapter 1); and Ambika Gautam (Chapter 2). Time -10 minutes each followed by Q&A
10:30	Tea/Coffee break
10:30	Writing session-2: Brief introduction of Chapter 3 and Chapter 4 by the authors and discussion and on how ILK and related cases can be included in the assessment report (Speakers: Gopal Rawat (Chapter 3); and Wu Ning (Chapter 4). Time -10 minutes each followed by Q&A

12:00	Lunch
13:00	Writing session-3: Brief introduction of Chapter 5 and Chapter 6 by the authors, and discussion and on how ILK and related cases can be included in the assessment report. (Speakers: Haripriya (represented by Madhav Karki) (Chapter 5); and Shyam Sharma (Chapter 6). Time -10 minutes each followed by Q&A
14:30	Reflections of the writing sessions by the Co-facilitators Ram P. Chaudhary and Madhav Karki
15:00	Tea/Coffee break
15:30	Panel Discussion: (2 ILK and 2 Authors; Chair: Krishna K Shrestha; Ways and means of facilitating ILK documentation in the sub-region and developing enable environment – Introduction of the summary of the questionnaire and discussion on possible structures to identify ILK holders and information relevant to IPBES process with a presentation by Yoichi Sakurai on the background of Sub-regional ILK network)
17:30	**Valedictory Session** Chief Guest: Ganesh Raj Joshi (Honourable Commissioner, Commission of the Investigation of Abuse of Authority, Government of Nepal) Chair: Chintamani Pokharel (Dean, Faculty of Humanities and Social Sciences, Tribhuvan University) 1. Closing Session: 1. Report of the Workshop by the Knowledge Integration and Writing Group 1, 2, and 3 2. Major Reflection Points from the Workshops and way forward ideas 3. Brief comments by IGES, ReCAST, ESON, CGED-Nepal and closing Remarks by the Chief Guest

	4. Vote of Thanks Workshop closes
18:00	Closing
18:00-19:00	A short tour to demonstrate culture and art in Dhulikhel, an old town inhabited by Newar ethnic community of Nepal.
19:00	Reception Dinner

Day 3: 2 December 2016 (Friday)

7:00 -16:00	**Excursion to observe indigenous forest and water management practices of indigenous and local communities and informal interactions with local communities in Dolakha District (sites: Bhiteri and Barkhe Danda CFUGs). The excursion took more time than expected due to bad road conditions.**
7:00 am	Participants left Dhulikhel Mt. Resort for Dolakha
9:45	Reached Boch Village Development Committee (VDC) and interacted with the Community Forest User Group (CFUG) Committee members of the BHITERI Community Forest (CF), and also visited the forest to observe their forest management practice. (Contact person: Kamala Basnet, President, Dolkha District FECOFUN).
10:45	Left for Charikot and had lunch at Hotel Panorama
12: 00 noon	Visited Barkhe Danda CFUG and interacted with CFUG Committee members and visited their forest; and also visited some places of cultural interest in Charikot, an old town in Dolakha District.
15:00	Departed for Dhulikhel

Inauguration Programme on Day 1: 30 November, 2016

9:00	Bouquet to Chief guest: Bishwa Nath Oli (Secretary, Ministry of Population and

	Environment, Government of Nepal)
9:05	Welcome remarks: Durga Prasad Pandey (Executive Director, ReCAST, TU) Yoichi Sakurai (Project Manager, JBF Project, IGES, Japan)
9:15	Opening of Workshop by chief guest by lighting the 'Panas' (traditional oil lamp)
9:20	Brief Introduction of Programme: Ram Prasad Chaudhary (Professor Emeritus, Tribhuvan University)
9:30	Introduction on ILK Dialogue Workshop in Context of the IPBES Work: Madhav Karki (IPBES, APRA & ILK TF)
9:40	Opening Speech: Bishwa Nath Oli (Chief Guest)
9:55-10:00	Vote of Thanks: Krishna Kumar Shrestha (President, Ethnobotanical Society of Nepal). Tea & Refreshments

2. Summaries and key points of cases presented by ILK holders and experts

This chapter presents the case studies submitted by selected ILK holders and experts representing ILK community in South and West Asian countries. The summaries presented are improved versions based on the discussions and reflections held during the dialogue sessions. It is noted that during the course of presentations, and follow-up deliberations with the assessment authors, key messages from each case study were distilled to target the IPBES-APRA that have been added by respective case study authors under sub-section c. The summary of each case study is presented below:

2.1 Invasive Weedy species of Abbottabad District, Threat to our Environment: Solutions through use of Indigenous Knowledge of Local Communities

a) Author(s), affiliation and contact

Dr. Saima Hashim
Department of Weed Science, University of Agriculture, Peshawar, Pakistan
Email: saimahashim@yahoo.com

b) Summary

The Project entitled "Invasive weeds a threat to the biodiversity: A case study from Abbottabad District [North-West] Pakistan" was jointly supported by the WWF- Pakistan and the University of Agriculture Peshawar, Pakistan in the year 2001-2002 (1 August 2001 - 1 January 2002). Dr. Saima Hashim was the Principal investigator and Prof. Kham B. Marwat was her supervisor. The project was highly relevant to all of the main regional assessment themes of IPBES. This finding states the status of distribution, history of invasion and management of the identified invasive weeds species. The project summary and findings are given below:

A survey was conducted using a sample of 200 farmers from 16 villages of Abbottabad District, during August 2001 to March 2002 regarding weeds. A total of 36 weeds were reported as problematic weeds, and out of that, only 16 species were reported as invasive, namely *Xanthium strumarium, Ipomoea eriocarpa, Alternanthera pungens, Trianthema portulacastrum, Tagetes minuta, Imperata cylindrica, Amaranthus hybridus, Robinia pseudoacacia, Broussonetia*

papyrifera, Ailanthus altissima, Pistia stratiotes, Phragmites australis, Parthenium hysterophorus, Cannabis sativa, Galium aparine and *Emex spinosus*. Among these invasive species, *Robinia pseudoacacia, Broussonetia papyrifera* and *Ailanthus altissima* were purposely introduced and all three are tree species, and they later on became invasive or at least aggressive, replacing or suppressing the local vegetation. Their distribution, history of invasion and management have been discussed in this manuscript.

c) Key points/messages of the case relevant to IPBES

- If introduced without proper monitoring, weed species, become invasive and affect the natural ecosystem.
- Policies need to be developed and strictly implemented to manage the invasive weeds.
- ILK need to be integrated and utilised for management of natural habitats and resources.

d) Website or other sources of information (If a website or other existing information about the project is available, please provide the link.)

A part of the report of this project was published under:

Saima Hashim and Khan Bahadar Marwat. 2002. Invasive Weeds a Threat to the Biodiversity: A Case Study from Abbotabad District, N-W Pakistan. *Pak. Jour. Weed Sci. Res.* **8**(1-2): 1-12.

Full project report was submitted to WWF-Pakistan after the successful completion.

e) Additional Authors and Key Contributors (Please list additional author/key contributor information, if relevant. Please indicate their affiliation as well.)

Two main authors are Saima Hashim (Currently Associate Professor, Department of Weed Science) and Khan Bahadar Marwat (Currently Vice Chancellor, SBB University Sheringal Dir Upper, KPK, Pakistan). This project was funded by WWF- Pakistan.

For the other Projects, the authors who contributed are :

Muhammad Tahir Khan, Saima Hashim, Shahida Ayub, Asad Jan and Khan Bahadar Marwat

f) Relevant literature, documents, videos or other recorded sources of information

g) About the ILK described in your recommended references

The ILK in my recommended references: It is of high importance to record the vanishing local

heritage of knowledge in the areas of farmers' indigenous knowledge and conservation of biodiversity and ecosystem services. It was observed that mostly elderly farmers, especially female farmers had in-depth awareness of the uses of various indigenous plants species and their medicinal uses. Male farmers were more aware of the increasing trend of the invasive weeds and their distribution. For the conservation of the biodiversity and ecosystem services the local indigenous knowledge needs to be recorded and there is a high need to do these for the management of risks to conservation of ecosystem in the face of climate change and anthropogenic activities.

2.2 Documentation of Indigenous and Local Knowledge on Medicinal Plants of Rahim Yar Khan District, Pakistan

a) Author(s), affiliation and contact

Dr. Muhammad Ibrar Shinwari

Environmental Science (Faculty of Basic and Applied Sciences), International Islamic University, Islamabad, Pakistan

Email: drmishinwari@yahoo.com

b) Summary

This one-year project was carried out in Rahim Yar Khan District of Punjab province in Pakistan and was completed recently in October 2016.

Pakistan is a country with the majority of the population living in remote areas (villages, tribes and deserts communities) benefitting from local medicinal plants in many ways. Rahim Yar Khan District is situated at 27°40'-29°16' N latitude and 60°45'-70°01' E longitude. It is a district of Punjab province in Pakistan. This district is divided into three main geographical zones: Riverine area, Canal irrigated area and Desert area known as Cholistan. It is situated in the south of the irrigated area up to the India-Pakistan trans-border. The district has an area of 11,880 Km^2. The total population of Rahim Yar Khan District is 3.3 million, of which 19.6% population live in urban areas. The climate of the district is hot and dry in the summer, and cold and dry in the winter season. The summer season is relatively longer than other seasons in this particular region; and starts in April and continues until October. The winter season is from November to March. The average rainfall is about 100 mm. The major tribes in the colony area are the Arain Jat, Rajput and Gujjar. They have all come from the adjoining districts of East and West Punjab. The old settlers are the Joya, Wattoo, Daudpota, Balouch, Syed and Pathan. In Cholistan area the Bohar, Lark, Bhen, came from Arabia to preach Islam. The Jats and Rajputs came from Rajputana and Jaisalmir and converted to Islam in the region of Feroz Shah Tughlak.

Rahim Yar Khan is a geographically and ecologically diverse area where local people possess indigenous knowledge on medicinal plants, but documentation of this is poor. This study aimed to prepare an ethnobotanical database and analyse the medicinal value of plant species by the local communities. The research methodology opted for the study is through extensive survey technique using 70 respondents from drug markets, as well as local people, and from 16 Hakims and

Homeopathic doctors. A total of 78 medicinal plant species were recorded belonging to 33 families and 66 genera from four study sites (Tehsil Rahim Yar Khan, Sadiq-a-bad, Khan Pur and Liaqat Pur). Fabaceae and Poaceae families are predominant. Based on indigenous and local knowledge, the most important medicinal plants found were *Aloe barbadensis, Calotropis procera, Coriandrum sativum, Ficus carica, Phoenix dactylifera, Tamarix aphylla* and *Ziziphus jujuba*. Plant species with the lowest medicinal value are *Bombax ceiba, Cocos nucifera, Convolvulus arvensis, Dioscorea cayennensis* and *Eucalyptus globulus*, etc. It is concluded that indigenous plant species play a very important role in the life of inhabitants of Rahim Yar Khan as these are the main source of herbal medicines. Detailed research is required and restoration of the natural habitat of these medicinal indigenous plants is recommended.

The authors highly appreciate the cooperation of local communities who contributed their indigenous knowledge to this study.

c) Key points/messages of the case relevant to IPBES

- Medicinal plants are an important source of health care for people living in remote areas.
- ILK about medicinal practice has been declining due to lack of relevant national policy.
- Proper policy need to be developed to conserve and sustainably utilise the medicinal plant resources.
- Follow-up research is recommended to protect the medicinal plant resources and associated knowledge.

d) Website or other sources of information.

Not Applicable

e) Additional Authors and Key Contributors.

Muhammad Rizwan Shahid

f) Relevant literature, documents, videos or other recorded sources of information.

g) About the ILK described in your recommended references

2.3 Status and Strategies for Conservation of Sacred Groves of Meghalaya, India

a) Author(s), affiliation and contact

Dr. Brajesh K. Tiwari
Department of Environmental Studies, North-Eastern Hill University, Shillong, India
Email: bktiwarinehu@gmail.com

b) Summary

Sacred groves are patches of pristine natural forests, a treasure trove of endemic, rare, endangered and threatened taxa of Meghalaya state of India and a part of Indo-Burma Biodiversity Hotspot. The project aimed to: (i) document the beliefs, knowledge, rites rituals and cultural practices and diversity of indigenous people (Khasi, Garo and Jaintia tribes) of Meghalaya associated with conservation and use of plants and animals found in the sacred groves; (ii) carry out mapping and make inventory of plant diversity in sacred groves including endemic, threatened, endangered and rare species included in Red Data book of IUCN; and (iii) formulate strategies for conservation of sacred groves.

c) Key points/messages of the case relevant to IPBES

- Sacred groves are biodiversity-rich habitats that maintain forest ecosystems with endemic, threatened, endangered and rare species.
- Sacred groves protect beliefs, cultural practices, rites and rituals of indigenous and local communities.
- Policy needs to be developed for the protection of sacred groves, which is often overlooked at the national scale.

d) Website or other sources of information.

http://onlinelibrary.wiley.com/doi/10.1046/j.1526-0992.1998.00068.x/abstract
https://www.researchgate.net/publication/267921284
https://www.researchgate.net/publication/309010769
https://www.researchgate.net/publication/234117237
https://www.researchgate.net/publication/282905634
https://www.researchgate.net/publication/299564918
https://www.researchgate.net/publication/290202091
https://www.researchgate.net/publication/282769839

e) Additional Authors and Key Contributors.

S.K. Barik, Department of Botany, North-Eastern Hill University, Shillong, India

R.S. Tripathi, National Botanical Research Institute, Lucknow, UP, India

f) Relevant literature, documents, videos or other recorded sources of information.

g) About the ILK described in your recommended references :

2.4 Cultural and Economic Value of Himalayan Giant Nettle (*Girardinia diversifolia*) in Eastern and Far-Western Regions of Nepal

a) Author(s), affiliation and contact

Mr. Bijay Raj Subedee

Research Centre for Applied Science and Technology (ReCAST), Tribhuvan University, Kirtipur, Kathmandu, Nepal

Email: gurusubedi@gmail.com

b) Summary

Girardinia diversifolia (Link) Friis, locally known as 'allo', has economic and cultural values for indigenous and local communities (ILCs) living in Kailash Sacred Landscape (KSL) which comprises four districts in Western Himalya, namely Darchula, Baitadi, Bajhang and Humla of Far-western Nepal; and in Eastern Himalaya, namely Sankhuwasabha District. Resource management, sustainable harvesting, conservation, and fair and equitable sharing of benefits enhance equity among the communities. Harvesting and processing system of 'allo' by the people of Bala, Sisuwa, Tamku Village Development Committees (VDCs) of Sankhuwasabha District and medicinal use of different parts of 'allo' used by Khar, Katae, Yerkot, sipti VDCs of Darchula District living in the Kailash Sacred Landscape (KSL), Nepal, are important for the sustainability of the resources.

This research, combining cultural and economic values using an approach with spatial methods, investigated the traditional use and practices linked with the sustainability of resources. The study investigated how local communities have established cultural linkage with harvesting, processing techniques and medicinal use of 'allo' in different regions.

Kulung Rai communities living in Eastern region of Nepal use 'allo' in their religious ceremonies like birth of new baby, Nagi (snake) Puja, wedding ceremonies and funerals. Different parts of the plant species are traditionally being used by local healers ('Baidhya and Dhami'); and local communities such as Thagunna (Chettri), Bohora, Manyal, in Darchula District. Local people use 'allo' as medicine for treating gastritis, joint pain, headache, tuberculosis and asthma. The study revealed that indigenous and local communities (ILCs) of Eastern and Far-Western regions use the fibre of 'allo' as a primary resource to prepare different types of products such as porter strap ('Namlo'), rope for domesticated animal ('Damlo'), coats, pants, bags, shawls, purses and many

more items. Mostly women are involved in ‘allo’ processing thus it acts as an income generation source for the women, where they utilise the income generated from ‘allo’ for their daily uses and also for their children’s well-being. The traditional spinning methods by hand spindle ('Katuwa'), and wooden hammer ('Mungro') are still in practice. White clay soil ('Kamero') is used to soften the fibres.

Changing circumstances has led to a higher demand of ‘allo’ products. Hence the residents of Darchula and Sankhuwasabha Districts started to harvest it extensively. The study also revealed that there has been high habitat competition with the extension of cultivation of cash crops like *Amomum subulatum* ('Alaichi') where both of the plant species have similar habitat requirements. As a result, natural stands of ‘allo’ population have been declining. Therefore, this study identified the existing situation of ‘allo’ for management and sustainable use to meet the increasing demand and also shares the management practices followed in different regions of Nepal.

c) Key points/messages of the case relevant to IPBES

- *Girardinia diversifolia*, locally called ‘allo’ is an important plant species in Nepal Himalaya that possess economic and cultural values to the indigenous people and local communities (IPLCs).
- The IPLCs, in particular women are custodians of the plant species that need to be sustainably harvested from wild as well as domesticated in the marginalised areas to contribute to land reclamation.
- Indigenous and local knowledge (ILK) associated with harvesting, processing and utilisation need to be protected as well as improved with technological interventions to bring the products of ‘allo’ into market with high demand.

d) Website or other sources of information.

http://www.icimod.org/search/?search=1&query=Khar%20VDC
http://www.pfaf.org/User/Plant.aspx?LatinName=Girardinia+diversifolia
http://www.flowersofindia.net/catalog/slides/Bichchhoo.html
http://www.gbif.org/species/7300847
http://flora.huh.harvard.edu/China
http://www.prota.org
http://ecocrop.fao.org/ecocrop/srv/en/home

e) Additional Authors and Key Contributors.

Prof. Dr. Ram Prasad Chaudhary, ReCAST, TU

f) Relevant literature, documents, videos or other recorded sources of information.

Barakoti, T., Shrestha, K (2008. "Commercial utilization of allo (*Girardinia diversifolia*) by the Rais of Sankhuwasabha for income generation". *Banko Janakari*. **18**(1): 18–24.

Dunsmore, J. (1998) "Microenterprise development: Traditional skills and the reduction of poverty in highland Nepal Himalaya", *Journal of the Association for Nepal and Himalayan Studies* **18**(2): 22–27.

Singh, S.C., Shrestha, R (1988) "*Girardinia diversifolia* (Urticaceae), a non-conventional fiber resource in Nepal". *Economic Botany*. **42**(3): 445–447.

Gurung, A., Flanigan, H., Kumar Ghimeray, A., Karki, R., Bista, R., Gurung, O.P. (2012) "Traditional knowledge of processing and use of the Himalayan giant nettle (*Girardinia diversifolia* (Link) Friis) among the Gurungs of Sikles, Nepal". *Ethnobotany Research and Applications*. **10**: 167–174.

g) About the ILK described in your recommended references :N/A

2.5 Project 1: Biodiversity and Livelihood Development in Land-use gradients in an Era of Climate Change, Project 2: Ethnoecology, Regeneration Pattern, Collection Techniques and Trade of Yarsagumba (*Ophiocordyceps sinensis*): In Dolpa Region of Nepal, Project 3: Community Forestry and Integrating Biodiversity of Nepal, Project 4: Building Capacity to Protect Biodiversity and Indigenous Rights through Documentation and Registration of Traditional Knowledge in Nepal

a) Author(s), affiliation and contact

Mr. Shiva Devkota

Ph.D. Scholar, Swiss Federal Research Institute WSL, Zurich, Switzerland

Email: shiva.devkota@gmail.com

b) Summary

Project 1: **Biodiversity and Livelihood development in Land-use gradients in an Era of Climate Change**

Principle Investigators: Prof. Dr. Christoph Scheidegger, Prof. Dr. Krishna Kumar Shrestha, Dr. Michael Nobis, Prof. Dr. Ram Prasad Chaudhary and Dr. Silke Werth

ILK holders: Inhabitants of Manaslu Conservation Area (Gorkha); Sagarmatha National Park Buffer zone (Solukhumbu) and; Kangchenjunga Conservation Area (Taplejung)

Duration: February, 2011-September, 2014

Specific Objectives:

· To identify and analyse threats and opportunities related to climate change in mountain belt of Nepal Himalaya.

· To study how different levels of land-use intensity (from primeval forests to arable fields) do affect biodiversity. The organisms studied include plants, lichens, mushrooms, butterflies, birds and Red Listed mammals (Flagship species).

Project 2: : **Ethnoecology, Regeneration Pattern, Collection Techniques and Trade of Yarsagumba (*Ophiocordyceps sinensis*) in Dolpa Region of Nepal**

Principle Investigators: Dr. (late) Damodar Prasad Parajuli, Mr. Shiva Devkota, Mr. Anil Shrestha

ILK holders: Inhabitants of Shey-Phoksundo National Park, Dolpa and its buffer zones communities, collectors from Rukum, Jajarkot and Salyan Districts.

Duration: May 2006 – Sep 2007

Specific Objectives:

· To document existing practices of harvesting Caterpillar fungus (*Ophiocordyceps sinensis*).

· To assess resource base of the study area by establishing permanent experimental plots and determine the regeneration trend of the species over two consecutive seasons

· To study ecology (distribution- frequency & density, altitudes, aspects, gradient, species association and preferred edaphic and climatic conditions) and morphology of Caterpillar fungus

· To study the trade channel of Caterpillar fungus and identify constraints in marketing

· To collect price information of Caterpillar fungus at different tiers from primary collectors to retailers/ wholesalers

· To determine contribution of Caterpillar fungus collection on rural livelihood and government revenue

· To study the ethnobotanical use of Caterpillar fungus to disseminate the findings of the research with a view to reform existing policy issues

Project 3: **Community Forestry and Integrating Biodiversity of Nepal**

Principle Investigators: Dr. Morten Christensen, Mr. Shiva Devkota, Mr. Sanjeev Bhattarai

ILK holders: Inhabitants of Annapurna Conservation Area, and other 15 districts of Nepal from eastern to far western regions of Nepal

Duration: July 2005 – October 2005

Specific Objectives:

· To know economically important mushrooms and their primary habitats and uses.

· To know how the collectors of wild edible fungi are characterised in terms of age, sex, ethnicity, and wealth.

· To quantify the contribution of wild edible fungi to rural livelihoods.

· To study present and forecast potential markets for edible fungi from Nepal

Project 4: **Building Capacity to protect Biodiversity and Indigenous Rights through Documentation and Registration of Traditional Knowledge in Nepal**

Principle Investigators: Shiva Devkota

Ph.D. Scholar, Swiss Federal Research Institute WSL, Zurich, Switzerland

ILK holders: Gurung community of Dhampus Village Development Committee, Kaski, Gandaki, Nepal

Duration: October – December 2004

Specific Objective:

· To document locally used biota by Gurung community and prepare community based biodiversity register (CBR)

c) Key points/messages of the case relevant to IPBES

- Different land use pattern in the Himalaya support diverse biodiversity that are being affected by land use intensity as well as climate change.
- Research and management is needed to sustainably utilise caterpillar fungus in the Himalayas.
- Research on wild edible mushrooms is needed to improve livelihoods of rural communities.
- Priority needs to be given to build the capacity of indigenous peoples' and local communities, as well as prepare community based biodiversity register.

d) Website or other sources of information.

Christensen, M., Devkota, S., Bhattarai, S. (2008a) Use of Wild Edible Mushrooms in the Annapurna Conservation Area, Nepal. *Journal of Mycology and Phyotopathology Society Nepal* **1**: 1–6.

Christensen, M., Bhattarai, S., Devkota, S., Larsen, H.O. (2008b) Collection and Use of Wild Edible Fungi in Nepal. *Economic Botany* **62**: 12–23.

Devkota, S. (2006) Yarsagumba [*Cordyceps sinensis* (Berk .) Sacc.]; Traditional Utilization in Dolpa District, Western Nepal. *Our Nature* **4**: 48–52.

Devkota, S. (2008) The frequency and relationship of flowering plants on the (Yarchagunbu) in the highlands of Dolpa District, Nepal. *Banko Janakari* **19**: 29–36.

Devkota, S. (2008) Distribution and Status of Highland Mushrooms: A Study from Dolpa, Nepal. *Journal of Natural History Museum* (Nepal). **23**: 51-59.

Devkota, S. (2010) *Ophiocordyceps sinensis* (Yarsagumba) from Nepal Himalaya: Status, Threats and Management Strategies. Cordyceps Resources and Environment (P.R. of C. Grassland Supervision Center by the Ministry of Agriculture, ed): pp. 91–108. Grassland Supervision Center by the Ministry of Agriculture, People`s Republic of China.

Devkota, S., Cornejo, C., Werth, S., Chaudhary, R.P., Scheidegger, C. (2014) Characterization of microsatellite loci in the Himalayan lichen fungus *Lobaria pindarensis* (Lobariaceae). *Applications in Plant Sciences* **2**: (5): DOI: http://dx.doi.org/10.3732/apps.1300101.

Katuwal, H.B., Khanal, B., Basnet, K., Rai, B., Devkota, S. (2013) The mammalian fauna from the Central Himalaya, Nepal. *Asian Journal of Conservation Biology* **2**: 21–29.

Katuwal, H.B., Basnet, K., Khanal, B., Devkota, S., Rai, S.K., Gajurel, J.P., Scheidegger, C., Nobis, M.P. (2016) Seasonal Changes in Bird Species and Feeding Guilds along Elevational Gradients of the Central Himalayas, Nepal. *Plos One* **11**: e0158362.

Pandey, N., Devkota, S., Christensen, M., Budathoki, U. (2007) Use of Wild Mushrooms among the Tamangs of Nepal. *Nepal Journal of Science and Technology* **7**: 97–104.

Rai, S.K., Sharma, S., Shrestha, K.K., Gajurel, J.P., Devkota, S., Nobis, M.P., Scheidegger, C.

(2016) Effects of the environment on species richness and composition of vascular plants in Manaslu Conservation Area and Sagarmatha region of Nepalese Himalaya. *Banko Janakari* **26**: 3–16.

Scheidegger, C., Nobis, M.P., Shrestha, KK. (2010) Biodiversity and livelihood in land-use gradients in an era of climate change - outline of a Nepal-Swiss research project. *Botanica Orientalis*: Journal of Plant Science **7**: 7–17. http://www.wsl.ch/fe/biodiversitaet/projekte/Biodiversity_Nepal/index_EN

e) Additional Authors and Key Contributors.

Project 1:

1 PhD Student - University of Bern, Bern, Switzerland

2 PhD students - Central Department of Botany, Tribhuvan University, Nepal

2 MSc students - Central Department of Zoology, Tribhuvan University, Nepal

5 MSc Students - Central Department of Botany, Tribhuvan University, Nepal

f) Relevant literature, documents, videos or other recorded sources of information.

g) About the ILK described in your recommended references.

2.6 Qanat, a Traditional Irrigation System in Iran

a) Author(s), affiliation and contact

Mr. Saeid Nouri Neshat
Boompajuhan Society, Tehran, Iran (Islamic Republic of Iran)
Email: nourineshat@gmail.com

b) Summary

Qanat means an underground gallery that conveys water from an aquifer or a water source to less elevated fields. In practice, a qanat consists of a series of vertical shafts in sloping ground, interconnected at the bottom by a tunnel with a gradient gentler than that of the ground. The first shaft (mother well) is sunk, usually into an alluvial fan, to a level below the groundwater table. Shafts are sunk at intervals of 20 to 200 meters in a line between the groundwater recharge zone and the irrigated land. From the air, a qanat system looks like a line of anthills leading from the foothills across the desert to the greenery of an irrigated settlement."

As defined by the international Center on Qanats and Historic Hydraulic Structures under the auspices of UNESCO: (i) Qanats create a reliable supply of water for human settlements and irrigation in hot, arid and semi-arid climates; (ii) qanat technology is known to have been developed by the Persian people sometime in the early 1st millennium BC and spread from there slowly west and eastward; (iii) the value of a qanat is to provide the quality, volume and regularity of the water flow; and (iv) qanats have a long-term value to the community in terms of livelihoods as agricultural production, cultural heritage during ceremonies and rituals, based on environmentally-friendly technique. The UNESCO World Heritage Committee in its 40th meeting in Turkey, inscribed eleven qanats in Iran on the World Heritage List that have been documented dating back 200 to 2500 years for reasons such as unique technologies used in digging qanats, and unique features like the oldest or the longest. However, the conservation of the qanat system is at threat. There is a need for policy improvement to recognise the qanat system in Iran and conserve it sustainably.

c) Key points/messages of the case relevant to IPBES

- Qanat system is a traditional irrigation system in Iran and provides a reliable supply of water for human settlements and irrigation.

- There is no major policy on conservation of qanats. Existing policies do not support the conservation of qanats, and therefore poses a challenge to its long-term sustainability. In addition, these traditional and local management systems have not been recognised nationally.
- The UNESCO World Heritage Committee, in its 40th meeting in Turkey, inscribed eleven qanats in Iran in the list of World Heritage Sites that have been documented dating back between 200 to 2500 years.
- Qanat management supports livelihoods of the people and is mainly undertaken by women.
- Climate change in the form of drought has an adverse impact in the qanat irrigation system.

d) Website or other sources of information

NA

e) Additional Authors and Key Contributors

NA

f) Relevant literature, documents, videos or other recorded sources of information.

1. Badjian, G. (2008) Nomadic Rangeland Management in past and present in a review: Changes, Challenges and Solutions. *Iranian journal of Range and Desert Research*, **14** (4): 2008.
2. Esmailniya, H., Sheykhali, M. (2013) Nomadic community development bottlenecks and solutions in Iran, *Journal of Agricultural and Natural Resources*.
3. 3. Papzan, A.H., Afshazadeh,N.(2010) Native mechanisms in range management of Kalhor tribe's nomads. *Iranian Journal of Range and Desert Research*, **17**(3), 2010

g) About the ILK described in your recommended references.

NA

2.7 Documenting and Revitalising Indigenous Knowledge of Nomads in Iran

a) Author(s), affiliation and contact

Ms. Bahar Mohamadifar

The challenges facing in local management of pastures by Bakhtiari nomads in the Tangsayad - Sabzkouh Biosphere reserves, Esfahan, Iran (Islamic Republic of Iran))

Email: physic_1982@yahoo.com

b) Summary

The “Behtash Pardaz Behruz” Research Team and Akhtar Sepehr Sepahan Company in line with recording and reviving the indigenous knowledge in cooperation with regional authorities and local communities and NGOs started to collect, analyse and practicalise the knowledge of local tribes in Iran. The project was planned in different subcategories and fortunately, the first phase was started in west of Iran where Bakhtiari and Qashqai tribes are present.

The organisational structure of the team consists of executive members, researchers, and a group of facilitators and social workers. Preliminary design of the project was developed by researchers and then the necessary permission and coordination with the people and authorities as well as NGOs were handled by members of the executive group. The facilitator group assisted among the tribes and local communities to collect and record the local knowledge and then reports were given to the research team for analysis.

The first phase of the project involved the role of pastoralists and their living style, and its correlation with land degradation. As a first step, the situation of resources and their change process in the west of Iran and lands of Qashqai and Bakhtiari were investigated. Simultaneously, the situation and changes of plant coverage, soil and water resources where tribes have customary systems were examined. Group facilitators and social workers also investigated the economic and social situation, and the direct and indirect pressures that are changing the situation of land resources.

In studies carried out so far, it was shown that increasing the number of cattle and early grazing had the largest impact on destruction. In contingency management of tribes on the grasslands, restoring the grasslands is only done through grazing and planting trees, but other local elements have been forgotten. The unknown status of lands in legal terms and not preventing the invasion to pasture lands granted to tribes still exist as the most acute conflicts among the local management with government regulations. Other findings were submitted in the report.

In order to solve the problems in pasture management and favourability of indigenous and formal

knowledge on the grounds of improved livelihood of nomad and rural communities, preserving and revitalising indigenous knowledge, reviewing and revocation of conflicting and contradictory laws, laws of land ownership, completion of the audit and issue updated documents freehold pastures and natural resources laws, producing educational content is proposed in the field of indigenous knowledge for new generation familiarity with benefits of this knowledge.

c) Key points/messages of the case relevant to IPBES

- Indigenous knowledge of nomads in Iran plays an important role in the management of pasture land.
- Increasing number of cattle and early grazing led to destruction of pasturelands as well as conflict with government authorities.
- There is a need to revitalise and document traditional knowledge in Iran to contribute to natural resource management.
- Migration management in Bakhtiari tribe
- Indigenous pasture management of Bakhtiari nomads
- The role of government policy in the nomads' settlement and rural unsustainable development and challenges created in indigenous pasture management of nomads.
- Rules of natural resources and the challenges ahead in indigenous management of pastures by nomads.
- The reluctance of young nomads to use the indigenous pasture management.

d) Website or other sources of information.

Currently, there is no source of information for presentation, but in the near future, the site of the local communities' knowledge of the nomads in Iran will be initiated after the data completion and their analysis.

e) Additional Authors and Key Contributors.

Research team members:

1. Ms. Bahar Mohammadifar (Project Manager and CEO Akhtar Sepehr CO)
2. Mr. Mortaza Ashrafi Habibabadi (Project Director & The Head of the Working Group on Land Degradation)
3. Mr. Mohammad Soltanolkotabi

Other partners:

1. Mr. Mehdi Mohammadifar (Head of the Working Group on Livelihoods and the Economy)

2. Mr. Mohammad Reza Momeni (Head of the Working Group on Documentation and Videos)
3. Ms. Marzieh Qaeli Nia (The Head of the Team of Facilitators)
4. Ms. Mahjoub Mohammadifar (Facilitator of the local communities)
5. Ms. Raziye Karimi (Head of the Working Group of Education)

Representatives of the cooperator organizations in the research team:
1. Dr. Shaian Shamohammadi (Head of the Shahr-e Kurd University)
2. Mr.Wafa Mahmoudinezhad (Department of Natural Resources and Watershed)
3. Ms. Nastaran Ashkani (Expert of the Environment Office)
4. Mr. Morteza Mohammadian Dehkordi (Expert of the Cultural Heritage and Tourism Office)

f) Relevant literature, documents, videos or other recorded sources of information.

g) About the ILK described in your recommended references.

The findings of this project indicate that the majority of nomads have the necessary awareness and knowledge about destruction of the natural resources and its consequences. However, issues such as lack of ownership of pastures and forests, shrubs for fuel, the disruption of Nomads migration, competition in cattle grazing, lack of flat lands for farming, etc. lead them to unwanted destruction of nature. Lack of integrated management of resources and the use of technology proposed brought many challenges to nomads' customary system. Also, the recent droughts have created many challenges for the nomads.

By studying and gathering information from elders and senior members of nomads, the research team concluded that the former system of using pastures has been forgotten and this issue has caused further destruction of pastures and non-compliance to customary frameworks in cattle grazing.

Restoration of customary ecosystems in nomad territory creates a farming system in line with the capacity of the land, and the tribes can exploit it without damaging the vegetation cover. Finally, since the nomads have obtained special indigenous knowledge that enables them to adapt to each geographic region (summer, winter and mid seasons), collecting and restoring this knowledge can effectively help to manage natural resources and prevent land degradation.

Due to the fact that shared strategy of development is based on local conditions, therefore, the appropriate management strategy for the development of livestock in tribal communities, and strategies and new methods must be used that are specific to social and cultural conditions tribes. Modelling and simulating of pasture management based on livelihoods desired for nomads will create the situation that can be achieved with the presence of indigenous structures and social

institutions.

According to the material, the following suggestions are offered for overcoming the challenges:

1. Improvement of nomad livelihoods helps to prevent further destruction of pastures by settled nomads.
2. Eradication of poverty of semi-nomadic tribes of nomads in winter, especially by the spread of work such as grazing, development of technical and vocational schools, the creation of conductive plans including strategies to improve the livelihood of nomads.
3. Ownership problem of grasslands such as giving pastures to tribes on condition of exploitation in accordance with the principles of land use.
4. Review of national law and regulations of forest and pasture, land transfer regulations.
5. Employment in crafts for tribal women and help to improve their livelihoods.
6. Rehabilitation and correction of poor and destroyed pastures with the support and partnership management of nomads and villagers.
7. Support packages to help nomads for grazing.
8. Traditional tribal councils to fill the gap in the system of nomad administrative and managerial systems.
9. Updates to the country's natural resources laws to solve problems created by conflicting laws.
10. Educational content for the younger nomad generation to become familiar with indigenous knowledge systems and traditional nomad systems.

2.8 Preparation of Marine Biodiversity Register and the Documentation of Traditional Knowledge and Indigenous Practices of Fishermen in the Trivandrum Coast, Kerala, India

a) Author(s), affiliation and contact

Mr. Robert Panipilla

Friends of Marine Life (FML), Kerala, South India

Email: robert_potsplants@yahoo.com; contact@fmlindia.in

b) Summary:

Project Aim

The project aimed to prepare the marine biodiversity register in the Trivandrum coast and to assess the traditional knowledge and indigenous practices of fishermen. This is an on-going research project.

Study context

In line with the international legislations such as the International Decade on Biodiversity, the Government of India passed 'The Biological Diversity Act' in 2002 and formulated 'The Biological Diversity Rules' in 2004. India has proceeded further in the land-based biodiversity registration. However, limited progress has been made on conservation of marine biodiversity. Therefore it seems that the current project is the first time in the history of India, where the marine biodiversity register is prepared by the Government of Kerala with the full cooperation of the traditional fishermen.

Study Site

The study site is located 7 km from Kovalam to Adimalathura in the Trivandrum District of Kerala, South India. This area is one of the few areas in the state of Kerala left with a higher presence of promontories and near inshore rocky reefs. The study site falls under the Coastal Regulation Zone (CRZ-for the coastal environment conservation regulations) 1 of the Government of India. This is important to highlight the fact that out of 590km of coastal line (9 coastal districts) in Kerala, an area of only 30km has promontories and cliffs. Among these, the Trivandrum District covers approximately 12.5km of the marine sensitive areas in Kerala. However, no studies have documented or explained the near inshore reefs and other reefs (CESS, 2015).

This area is one of the largest fishermen settlements in Kerala. Key information is that the proposed Vizhinjam International Transshipment Port project is scheduled to be built in this area, which did not consider the knowledge, practices and livelihood of the traditional fishermen in this area.

Methodology

The project was conducted by a group of indigenous researchers under the leadership of Mr. Robert Panipilla in collaboration with traditional knowledge holders (TKHs) and local/ traditional fishing communities. The following steps were taken for the data collection:

1. Identifying and listing the most experienced reef fishermen among the coastal communities in Trivandrum.
2. Interviewing these fishermen (about 100 reef fishermen, skin divers, trap fishermen, gun fishermen and shell collectors) and document the Ecological Sensitive Area (ESA) through their knowledge and experiences, and document their traditional knowledge.
3. Joint visit by the ESA (Project team and traditional fishermen).
4. Underwater diving with the help of professional scuba divers: in order to verify the information gathered from the traditional fishermen.
5. Visual documentation of marine seabed ecosystems using underwater videos and photos.
6. Mapping of the seabed ecosystems and analysis of marine biodiversity.
7. Verification with established Government scientific research institutions.

The main findings are as follows:

Number of species have identified so far under the project are: (a) 36 species underwater rocky reefs; (b) more than 500 types of mollusk; (c) more than 400 types of crab; (d) more than 150 Marine worms such as Sipuncula phylum, Nematode (round worms) phylum, and
Annelida phylum; (d) more than 300 types of bridle star; (e) more than 50 species of sponge; (f) more than 30 species of coral; and many others. The most important finding is fishing-related seabed ecosystems. This explains the fact that the study area is blessed with rich biodiversity.

The preliminary assessment by the Department of Aquatic Biology, at the Kerala University suggests that many species in the list are not identified or included in the record of the Government of Kerala. The taxonomical classification of these is being undertaken by the Kerala State Biodiversity Board.

It was identified that the traditional fishermen possess the knowledge about the fish species and their associations, food chain, their reproduction, their maturity and the habitat and life span.

The traditional fishermen have the appropriate and adequate knowledge of climatic condition and about the changes in the harvest and due to the changes in natural phenomena.

Through the avoidance of destructive fish techniques such as trawling and net fishing in the reef areas, they conserve the marine biodiversity of the sea. They also resist the use of trawlers; in fact, they have a history of destruction from 14 trawlers over the last few years.

The fishermen appeared to be skeptical about modern fishing devices like motorized fishing gear, nets of smaller mesh size, or dynamite fishing, which they think would pose a threat to increase

the pollution, destroy the natural environment and affect fish biodiversity.

A major threat to the biodiversity of the current research site is identified as the proposed Vizhinjam Container Transshipment Port project.

c) Key points/messages of the case relevant to IPBES

- Marine biodiversity is rich along the Trivandrum coast, Kerala, India, but taxonomic identification of marine biodiversity is needed to document the taxa.
- Traditional fishing practice has been sustainable to conserve the marine biodiversity.
- Modern fishing practice and current environmental problems such as pollution, destroy the natural environment.

d) Website or other sources of information

http://fmlindia.in/

http://www.newindianexpress.com/cities/thiruvananthapuram/2016/aug/22/Fishermen-in-coastal-Thiruvananthapuram-catch-three-rare-species-of-shark-1511713.html

http://www.thehindu.com/todays-paper/tp-national/tp-kerala/Fishermen-net-three-species-of-rare-sharks/article14580937.ece

http://www.newindianexpress.com/cities/thiruvananthapuram/2016/aug/09/Rare-finless-porpoise-netted-1507164.html

http://www.thehindu.com/news/cities/Thiruvananthapuram/Marine-survey-documents-rare-sea-slugs-off-Vizhinjam/article14513072.ece

http://m.dailyhunt.in/news/india/english/the+new+indian+express-epaper-newexpress/colony+of+marine+worms+faces+wipeout-newsid-48218922

http://m.dailyhunt.in/news/india/english/the+new+indian+express-epaper-newexpress/danger+sign+on+seabed+off+kovalam-newsid-48135958

http://www.in.undp.org/content/india/en/home/operations/projects/environment_and_energy/mainstreaming-coastal-and-marine-biodiversity-into-production-se.html

e) Additional Authors and Key Contributors

Dr. Biju Kumar (Head of the Department of Aquatic Biology, University of Kerala, India) bijukumar@keralauniversity.ac.in

Dr. Johnson Jament (Indigenous researcher in education, biodiversity and cultural aspects of fishermen); jjohns79@gmail.com

Aneesha Ani Benadict (MSc second year student, Marine Biology and Ocean Studies, Pondicheri University, India) srmercaneesha@gmail.com

f) Relevant literature, documents, videos or other recorded sources of information

National Biodiversity Authority, India (2013) People's Biodiversity Register. NBA: Government of India

Panipilla, R. (2015) Eyes on their Fingertips. Chennai: International Collectives in Support of Fisher workers (ICSF).

Ministry of Environment & Forest, Government of India (2012) Shoreline change assessment for Kerala coast. National Centre for Sustainable Coastal Management (NCSCM). New Delhi: Government of India.

Panipilla, R., Rajan, M. (2014) A participatory study of traditional knowledge of fishing communities in the Gulf of Mannar, India. Chennai: ICSF.

Nirmale, V., Sontakki, B.S., Biradar, R.S., Metar, S.Y. (2004) "Assessment of Indigenous knowledge of coastal fisherfolk of Greater Mumbai and Sindhurg Districts of Maharashtra", *Indian Journal of Traditional Knowledge*, **3**(1): 27-36.

Prasad, L., Jalaj, R., Pandey, S., Kumar, A. (2013) Few Indigenous fishing method of Faziabad district of Eastern Uttar Pradesh, *Indian Journal of Traditional Knowledge*, **12**(1): 116-122.

g) About the ILK described in your recommended references

Much of this literature explains the traditional knowledge of fishermen in relation to their fish catch, traditional method of fish catches and sustainable uses of marine resources.

The referred studies suggest that indigenous fishing methods are some of the most suitable, convenient, economical and environment friendly and sustainable fishing techniques.

Some studies also report the benefits of indigenous and traditional knowledge for the appropriate use of resources in the locality.

Most of these studies have been conducted in the north-eastern parts of India. However, limited studies explore the traditional knowledge and practices of indigenous/traditional fishermen in South India.

This information is very helpful for the assessment of sustainable use and conservation of marine resources, which is one of the areas that need to be explored further and more studies need to be conducted.

2.9 Sustainable Resource Use and Forest Conservation by the Kaani Indigenous Community of Kanyakumari Forest in the Western Ghats, India

a) Author(s), affiliation and contact

Mr. Davidson Sargunam Selvanayagam

Tribal Foundation, Western Ghat, Tamil Nadu, India

Email: ssdavidson9@gmail.com

b) Summary

The Kaani indigenous people live in 48 Settlements in the deep jungles, forests and hills of Kanyakumari - a biodiversity hotspot of the Western Ghats in India. The district receives 2 monsoons and maintains a mediocre climate between 22^0C and 32^0C. The Kaani people derive everything from the forests for their sustenance, survival and livelihood and live in consonance with nature, according to natural cycles.

They used to cultivate tubers and many kinds of agricultural plants including tapioca and banana, coconut, areca nut, pine apple, vegetables and spices such as pepper, cinnamon, bay leaf, cloves and nutmeg. They gathered wild honey, mushrooms, tubers and hunted small wild animals including bandicoot, white rat, mouse deer, tortoise, bats, squirrels and wild boar. Due to ban on hunting, they currently refrain from hunting.

Hyena, fox, and wolf have been completely decimated, and the population of tiger, leopard, wild dog (dhole) and wild cat have been drastically reduced. Meanwhile there has been a radical reduction in the number of snakes such as viper, cobra and king cobra that has resulted in severe distortions in the eco-balance of animals, and caused an increase of animals such as bonnet monkey, wild boar, hare, banking deer, squirrels, bandicoot and rats that destroy the existing agricultural crops.

Owing to the increase in some vermin populations such as wild boar, porcupine and monkey due to eco-imbalance and strict conservation efforts, the ratio of 'Predator versus Pest' is heavily distorted and 'Human versus Animal Conflict' is increasing. This wreaks a high degree of damage, destruction and devastation to agricultural crop. Subsequently, the majority of tribal people have stopped practicing agriculture. This has resulted in the existing paradox of rich lands, poor people.

As the majority of tribal people abandoned agriculture, they depend on the distribution of free rice of 35 Kg. per month per family for those below the poverty line. Many of them go to work as coolie labourers on private plantations or migrate to nearby villages, towns and neighbouring

states seeking new pastures as coolie labour.

The Kaani people live in traditional air-cooled bamboo thatched huts consisting of a single room without ventilation. The kitchen using forest firewood is located outside the hut. The huts are made of bamboo and forest wood, thatched with grass, reed leaves and woven coconut leaves; the majority of them have no toilet. Water in the hill streams are channelled by hose and use surface rainwater, which is not purified and not distilled.

While conducting medicals camps in various settlements by the Tribal Foundation, it was revealed that diabetes and high blood pressure are comparatively very low, just 2 to 3 percent. No case of cholesterol, obesity and over-weight were reported. It was revealed in our analysis that people with diabetes are those who maintain social intercourse with people in the plains i.e. non-indigenous people, and who were used to consuming food in hotels and drinking liquor from the government liquor shops (made of chemicals). In the case of childbirth, there are no cases of caesarean births, and deliveries take place in the huts. The tribal people never consume packaged food, bottled drinks or fast food.

At the attainment of puberty, around at the age of 13 or 14, girls are married. Consequently, many abortions are reported. Infant mortality is very high and the newborn babies weigh 1.7 to 2.2 kgs, the majority of whom eventually die. Pre-natal and post-natal care is unknown. They never administer inoculations, vaccinations or resort to preventive measures.

Both sexes consume illegally brewed indigenous liquor and palm wine, illegally extracted from palms in the jungles. Many men consume liquor in the mornings and both sexes use 'paan', a mixture of betel leaves, raw areca nut, and raw tobacco with a pinch of calcium.

The Kaani people have strong attachments to nature. They are traditional animists and nature worshippers. They participate in conservation activities endorsing the efforts of the Forest Department in serving as guides, informants and resource persons for researchers and academicians. They check poaching and hunting by reporting any movement to the Forest Department and report any suspicious movement by non-tribesmen into the forests. While collecting herbs, they pluck only the top portions, leaving part of the plant for regeneration and conservation of species.

The Forest Department seeks help from the indigenous people to track, rescue and treat wild elephants, big cats and other animals, as the Kaani people have traditional innate knowledge and skill in elephant tracking and vast knowledge of the flora and fauna, as well as thorough knowledge of the forest terrain. While hunting edible mushrooms, they do not pluck all the mushroom at one place, but leave some of them for regeneration to propagate the species. They do not use chemical fertilizers, insecticides, weedicides, herbicides and thus conserve the fertility and

health of the soil.

They use spades, pick-axes and indigenous, innovative tools to till the ground and season the soil. They avoid mechanized ploughs and do not use tractors or other powered mechanised equipment. Currently the indigenous people feel the impact of global warming and associated climate change related hazards and risks in protecting and conserving their knowledge and practices. From 2010 to 2014 August, they experienced erratic monsoons and monsoon failure, and consequently drought and terrible water scarcity were felt. All hill streams dried up and the dam registered just 4 feet (1.21m) instead of its maximum capacity of 48 feet (14.63m).

Global warming has an impact on the population and nesting of wild honey bees, growth and regeneration of mushrooms, breeding of wild hare, breeding of human-friendly butterflies, ferns, mosses, orchid species and minor animals as observed and revealed by the indigenous people. Teams of scientists and environmentalists have also made this observation of heavy damage to biodiversity by climate change.

During this drought period, unidentified viruses affect the people, and physicians treated them for the usual virus infection, according to the tribal community. Physicians reported that viruses would have attained the process of mutation.

There is a vast change in the rain pattern. For example, during the summer months (February to May), rains destroy honey bees, creating infection in honey bee colonies, and which affect breeding of birds through non-fertilisation of eggs, etc. The South West Monsoon should start from the first day of June, but sometime it is delayed or fails altogether. Erratic monsoons, drought and truant monsoons are felt, which may be due to the impacts of global warming and climate change.

The Kaani people are a rich repository of ethnobotany having knowledge of over 300 species of medicinal plants and their uses. Kanyakumari District has about 1,200 indigenous medical practitioners, apart from the Kaani tribal people. Some of them have studied in college with registered degrees recognised by the government.

The government has banned hunting and the indigenous people have refrained from hunting. They rear country chickens at home to meet their need for meat, in addition to buying from markets in nearby villages, by travelling to villages. There is a ban on cutting bamboo and forest timber in force and people have switched to building houses with hollow cement bricks.

Human versus animal conflict is increasing, and tribal people depend on the free distribution of rice from the government. As they are not carrying out agriculture in a full-fledged manner, both men and women go to work on private rubber plantations to earn daily wages, while some work in

government plantation earning daily wages to maintain their living.
The government gives priorities to them on community basis in education and employment as they fall below the poverty line, and in consideration of their poor socio-economic status (the estimated minimum level of income needed to secure the necessities of life).

The Indian Forest Act of 1972, with follow-up amendments, aims at conservation of forests, the flora and fauna, waterways and everything that exist in the forest. Although some of the provisions of the Act are detrimental and an infringement of the traditional rights of the indigenous people, they pay due respect to the laws of the land and participate in forest conservation.

Sociologically, this indigenous community is non-violent, peace-loving and law-abiding, and act according to the Forest Laws. However, recently land mafia gangs, encroachers, vested interests and disgruntled politicians instigate the innocent, illiterate and gullible tribal people to agitate and demonstrate against the government.

The Kaani people have some equipment that they use to drive away animals, to save their agricultural crops. They use the following tools:
1. **Adi-udukku**: A piece of bamboo, measuring about 3 feet with part of the top portion removed. A cut is made perpendicularly in the bamboo. When it is operated manually, one half moves upwards and strikes the other bottom half, creating noise so that animals are scared and run away from the field. This tool is used to scare away wild animals such as monkeys and squirrels that destroy the crops.
2. **Herb to deter wild honeybees**: They use a herb to ward off the wild honeybees, while they gather honey. They use the herbal leaves as a smoker to deter the bees and smear paste from a tuber on their bodies so that bees are not able to smell them. In this process, they do not kill the bees, thereby helping in the conservation of bees and biodiversity.
3. **Kudukkai**: This is a piece of bamboo about 3 feet long with a reaper of one foot long attached at the middle, tied to a string. When the tool is in operation, the attached wooden piece strikes at the central bamboo creating noise that scares the animals away from the agricultural fields. During the day, it is operated manually and during the night it is attached to a tree branch and a small piece of a coconut leaf or a twig is attached down below, which moves in the wind during night. When the branch moves, the middle stick strikes at the base structure of the bamboo that creates noise, scares and deters the wild animals that intrude into the fields. During the day, monkeys and squirrels are driven away, and during night wild boar, sambar, mountain goat, porcupine and hare are chased away.
4. **Kal- Vil** (Stone bow): This consists of a bow with two strings and in between the strings at the middle, they are united. Between the strings, for 2 inches there is a rectangular space covered by woven thread, where a stone can be attached. Instead of an arrow, a round stone is used. This bow

is used to expel monkeys and squirrels that destroy the crops during the day.

5. **Nanthini**: This is a bamboo tool that serves to deter animals from agricultural areas, by creating noise during the day. It is made of bamboo, 3 feet in length, where part of the top portion is cut off. Down below a small area is left out and below that an area of one inch is cut off and removed. When the user strikes the top portion with 2 sticks each measuring 1 foot, it creates noise to scare the animals.

6. **Thoori**: This is a piece of equipment to hunt fish in the ponds, river streams and banks of dams in shallow waters. It is 4 feet in length, made of bamboo and reeds with the ribs of coconut palm leaves. It has a locking system that once a fish gets inside of it, it automatically locks and the fish cannot escape from the equipment.

7. **Use of Pestle & Mortar**: They use wooden pestle & mortar to manually grind rice, dried tapioca, edible nuts and other food materials into powder. They carve both the tools manually. There is no need for electricity or any other mechanisation to operate this.

8. **Grinding tool**: For wet grinding to make coconut paste and masala paste (various ingredients as chilli, pepper, cumin, turmeric and salt to make a paste, which is added to food while cooking). They use indigenously carved granite stones, one for the base and another for applying for pressure on the top to grind. It needs no energy or any sort of mechanisation.

c) Key points/messages of the case relevant to IPBES

- The Kaani, an indigenous people in the Western Ghats, India possess rich repository of ethnobotanical knowledge of medicinal plants. However documentation of indigenous knowledge is essentially needed to conserve the resources and cultural heritage associated with the resources.
- The tools, practices, and products of ILK are useful to resolve/minimise human-wildlife conflict, and contribute to promote sustainable use of biodiversity.

d) Website or other sources of information

www.tribalfoundation.in

Tribal Foundation (Nagercoil): Many talents, one team ...

www.indiantribalheritage.org/?p=12800

Kani tribe uses age-old techniques to good effect

http://www.thehindu.com/news/national/tamil-nadu/kani-tribe-uses-ageold-techniques-to-good-effect/article5975207.ece

Tribal Foundation Nagercoil mobilises Kaani children to ...

www.indiantribalheritage.org/?p=8290
Plastic waste campaign by the Tribal Foundation Nagercoil ...
www.indiantribalheritage.org/?p=6845
A taste of rich food culture - The Hindu
www.thehindu.com/todays-paper/tp-national/.../article4177390.ece
Kaani Tribal Storytelling Festival - World Storytelling Institute
www.storytellinginstitute.org/777.html
Free eye camp organised by tribal foundation, Nagercoil
https://www.facebook.com/bejansingheye/posts/699735383407597
Tribal Foundation Nagercoil | Search Results | Tribal ...
www.indiantribalheritage.org/?s=Tribal+Foundation+Nagercoil
Tribal Foundation Nagercoil mobilizes Kaani children to ...
www.indiantribalheritage.org/?p=8290
Stories get a new beginning - Times of India Publications
mobilepaper.timesofindia.com/mobile.aspx?.
Increase forest cover to mitigate climate change - NIDM
nidm.gov.in/PDF/DU/2013/April/23-04-13.pdf
Slideshow | Eco-awareness programmes in an “Ecologically Fragile Area”: Kanyakumari District (Western Ghats) – Tamil Naduhttp://carnaticstudent.org/wordpress/indiantribalheritage/?tag=kani
World Indigenous Peoples Day celebrated by Kaani tribal people in the West Ghats: Tribal Foundation – Tamil Nadu
http://www.indiantribalheritage.org/?p=15565
Harvesting honey in Kanyakumari District: Kaani community honeybee project – Tamil Naduhttp://www.indiantribalheritage.org/?p=14098
Celebrating the United Nation’s International Mountain Day with the Kaani community at Vellambi (Western Ghats) – Tamil Nadu
http://www.indiantribalheritage.org/?p=13503Kani storytelling festival 2013: Biodiversity and Preservation of Culture – Tamil Naduhttp://www.indiantribalheritage.org/?p=13074
Disease resistant banana saplings distributed to Kaani community – Tamil Naduhttp://www.indiantribalheritage.org/?p=13069
Organic cultivation of banana varieties with medicinal properties by Kaani community – Tamil Naduhttp://www.indiantribalheritage.org/?p=12303
Kaani customs: Continuity and change in the hills near Kanyakumari – Tamil Naduhttp://www.indiantribalheritage.org/?p=11909
Indigenous food, culture and identity of the Western Ghats: “Practitioners Conclave” at Mahabaleshwar – Maharashtrahttp://www.indiantribalheritage.org/?p=11894

Environmentalists join hands in order to protect biodiversity: Saving four rare bird species in the Kanyakumari region inhabited by the Kaani community – Tamil Nadu
http://www.indiantribalheritage.org/?p=11528
International Day for Biological Diversity 2013: Tribal school programme in Kanyakumari District – Tamil Nadu
http://www.indiantribalheritage.org/?p=11403
Bamboo is the lifeline of the Kaani tribe living in the forests of Kanyakumari District – Tamil Naduhttp://www.indiantribalheritage.org/?p=11367
Doctorate on edible mushroom: Applying traditional knowledge of people belonging to Kaani tribe in the Western Ghats – Tamil Naduhttp://www.indiantribalheritage.org/?p=11016
Study on ethno-medical practitioners among the Kaani community: Indigenous knowledge on medicinal plants is gaining recognition worldwide – Tamil Naduhttp://www.indiantribalheritage.org/?p=10231
Slideshow | Dengue prevention campaign for the Kaani community – Tamil Naduhttp://www.indiantribalheritage.org/?p=10204
Mountain ecosystems also needed by urbanized areas: International Mountain Day observed with Kaani tribal community – Tamil Nadu http://www.indiantribalheritage.org
http://www.indiantribalheritage.org/?p=10231
Study on ethno-medical practitioners among the Kaani community: Indigenous knowledge on medicinal plants is gaining recognition worldwide – Tamil Nadu

e) Additional Authors and Key Contributors

1. Dr. Selvin Samuel (Former Head, Dept. of Botany, St. John's college, Palayamcottai, Tamil Nadu, India)
2. Dr. Sam Manohara Das (Former Head, Dept. of Zoology, Scott Christian College, Nagercoil, Tamil Nadu, India)
3. Mathew Lourdu Rajiah (Ethno-musicologist, 18,Second Link Road, Sadsivam Nagar, Madipakkam, Chennai-600091, Tamil Nadu, India)

f) Relevant literature, documents, videos or other recorded sources of information

g) About the ILK described in your recommended references

ILK Holders: Kaani indigenous people of Kanyakumari forests in the Western Ghats. I am providing the required details based on the key Questions and ILK of the Kaani indigenous community. The team led by S. Davidson Sargunam, an environmental educator, who serves them for over 20 years. The team has studied the indigenous people for the past 8 years. The intangible

cultural heritage can be used for the development of humanity if considered relevant and adaptable.

The tools and practices may be documented as there is a lack of proper documentation and such practices are vanishing. Owing to the cultural transformation through mass media, communication revolution and free trade, the younger generation is not showing interest in their culture.

The tools, products of ILK, are useful to counter human-wildlife conflict without harming the forest biodiversity and promote sustainability, which may be replicated if found feasible.

2.10 Integration of Different Knowledge Systems in the Asia Pacific Regional Assessment of the IPBES

a) Author(s), affiliation and contact

Dr. Madhav Karki (CLA Chapter 1)

CGED-Nepal, Kathmandu, Nepal

Email: karki.madhav@gmail.com

b) Summary

Indigenous and local knowledge and practices (ILKP) provide a good basis for developing biodiversity and ecosystem resources management strategies in response to growing climatic and socio-economic changes and challenges. ILKP can help design cost-effective, participatory and sustainable conservation, development and adaptation practices since they are based on tried and tested local knowledge and skills and practices. The main principles for working with ILKP in IPBES assessments are: a) bringing ILKP community into dialogue with modern knowledge systems; b) providing opportunities for dialogue with Indigenous Peoples and Local Communities (IPLC) focusing on topics relevant to IPBES; c) allowing time for decision-making through customary and traditional institutions to identify common goals; d) pursuing dynamic and interactive ways for working with ILK and natural and social science communities in the Platform; e) practicing a participatory and inclusive approach in all IPBES work; and f) enriching the dialogue between knowledge systems as a two-way process of "receiving" and "giving back" in terms of knowledge, learning and good practices.

c) Key points/messages of the case relevant to IPBES

Key issues in assessing and integrating the contribution of ILKP in the IPBES assessment are the following:

•Property rights or ownership of indigenous and local knowledge (ILK) are not well defined;

•National policies in support of ILK for conservation and development do not exist or exist in an scattered manner;

•Role and application of growing information and communication technology (ICT) especially

mobile and digital technologies in promoting ILK is not highlighted and used;

•ILK being highly contextual are often questioned for validity by the scientific and modern science community, which is not a fair practice as there is a huge asymmetry between the resources the two systems have access to;

Therefore the IPBES Regional Assessment Methodology for the Asia Pacific region suggested the following steps:

•Multiple methods, approaches and tools;

•Socio-ecological systems approach recognising the inherent embedded nature of human-nature interdependence and synergy especially in numerous bio-cultural landscape of AP;

□Systematic literature review to identify the key issues, gaps, challenges and opportunities in both the ILK and scientific knowledge systems;

□Key global and regional processes such as Nagoya protocol of CBD climate change adaptation and mitigation approaches of the UNFCCC and sustainable development goals (SDG) of the UN;

□Identification of the existing gaps in the knowledge and practices in all the knowledge systems and their outcomes;

□Useof synthesised knowledge by integrating ILK and modern scientific knowledge though collective dialoguing and piloting including scenario building of plausible future of biodiversity and ecosystem services.

For more information visit www.ipbes.net

d) Website or other sources of information
http://www.unesco.org/new/en/natural-sciences/priority-areas/links/science-policy/projects/indigenous-knowledge-within-the-framework-of-ipbes/

e) Additional Authors and Key Contributors
ILK Task Force Members of the IPBES

f) Relevant literature, documents, videos or other recorded sources of information
http://www.unesco.org/new/en/natural-sciences/priority-areas/links/knowledge-transmission/

g) About the ILK described in your recommended references

MoSTE (2015). Indigenous and Local Knowledge and Practices for Climate Resilience in Nepal, Mainstreaming Climate Change Risk Management in Development, Ministry of Science, Technology, and Environment (MoSTE). Vol. 1: Synthesis Report; Vol. 2. Case Studies. Publisher, Govt. of Nepal; ISBN: 978-9937-2-9310-5; http://ppcr.moste.gov.np/wp-content/uploads/2015/03/ADB-report-final_Web.pdf; http://ppcr.moste.gov.np/wp-content/uploads/2015/03/Indigenous_Complete_web.pdf

2.11 Management of natural resources: Case study in the Kailash Sacred Landscape Conservation and Development Initiative

a) Author(s), affiliation and contact

Dr. Ram Prasad Chaudhary

ReCAST, Tribhuvan University, Kathmandu, Nepal

Email: ram@cdbtu.wlink.com.np

b) Summary

Indigenous system of management of natural resources is deeply embedded in cultural values espoused by local communities both as a group, as well as an individual. Under the project, we explored the role of customary arrangements and the enabling factors that allow the informal local and community-based institutions in Humla District, a part of the Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI) to be effective in pasture management where the grasslands are important livelihood resources.

The KSLCDI is a transboundary collaborative programme between China, India and Nepal that has evolved through a participatory, and iterative process among various local and national research and development institutions within these countries. The project has been initiated in Nepal as a collaborative project of the Ministry of Forests and Soil Conservation, Government of Nepal; International Centre for Integrated Mountain Development (ICIMOD); and Research Centre for Integrated Mountain Development (ReCAST), Tribhuvan University, Nepal with financial support from DFID and GiZ. The programme aims to achieve long-term conservation of ecosystems, habitats and biodiversity while encouraging sustainable development, enhancing the resilience of communities in the landscape and safeguarding the cultural linkages between local populations at transboundary scale. The KSL-Nepal comprises four districts in Nepal - Baitadi, Darchula, Bajhang and Humla; located in far-, and mid- western regions in Nepal. In KSL-Nepal, religious and social institutions have played a particularly important role in the management and conservation of resources.

Local communities have developed resource governance institutions over the years. In Limi Village Development Committee (VDC) of Humla, comprising three villages of Halji, Tila, and Zhang, the local resource governance system comprises authority and a set of rules. The community system is weaved with the cultural practices. Hierarchy in the society and the selection

of authorities for management of community system are closely linked with the parental property inheritance system associated with the polyandry system of marriage. People here follow impartible primogeniture inheritance system of property, where the eldest son inherits the property and is not normally divided among the brothers. The eldest son of the family who inherits the property becomes a Dhongba. If younger brother does not share the same wife and separates, he gets a smaller proportion of the property and becomes a Dhongjung. The unmarried sisters who separate from their brothers become Bhomdang. Bhomdang gets an even lesser proportion of property than Dhongjung. Dhongba refers both to individuals and estate. The number of Dhongba in a village always remains the same, but the number of Dhongjung and Bhomdang may increase or decrease.

The Chairperson of the VDC and the ward representatives are selected following a system called Hipsing, wherein lotteries are drawn in the name of each individual (Dhongba and Dhongjung only) for a period of five years. There are two more types of officials called Loiba and Lora, which are rotated annually. Loiba are responsible for monitoring forest and pastureland, and Lora are responsible for ensuring animals do not stray in the fields. Each village has two Lora and only the Dhongba households are eligible to become Lora. If animals are found straying in the field the owner has to pay a fine consisting of both grains and cash. The cash component goes to the community fund and the grain is kept by the respective Lora. The number of Loiba, who look after forest, ranges from 4 to 6 representing both Dhongba and Dhongjung households.

The Loiba checks each load of firewood just before people enter the village, and if anyone is found picking fresh branches, he/she is fined up to Rs 5,000. These forests have not been formally handed over as community forests, but the communities have been protecting them on their own initiative. People take oaths before religious idols to refrain from collecting fresh tree parts or felling any trees. Such oath-taking is respected by every individual. The healthy forests and sight of wild animals like blue sheep stand testimony to the conservation ethos of the local community. People have agreed not to harvest any herbs from community-owned land. Not only forests, but agricultural practices and calendar of operations are decided by the community and all operations are strictly carried out as per the plan.

The three villages of Limi collectively own the pastureland, and communities decide the rotation of pastureland following a seasonal calenda. All the animals are taken to summer season/ pasture, called Soika after planting of crops. In some villages, pack animals such as dzo and horses are not taken to the pasture lands and are grazed near the villages. The pastures for rainy season called Yarka are higher up. Usually around August with the onset of Tonka, pastoralists start bringing

down their animals to lower elevation pasture. The Tonka pastures are the same as Soika pasture. Around the end of the Tonka season, crops are also harvested and animals are brought back close to the village when the Ghunka, winter season begins. These rotational grazing systems are closely monitored and regulated by the community. If any individual is found grazing animals in Ghunka pasture in other season, he/she is severely punished. Even within a particular seasonal pasture, the community makes decisions as to where to take animals so that pasturelands are maintained. People take their animals to Ning Khola, Talung, Artang in Soika; to Shakya Khola, Gyau Khola in Yarka; Talung, Ning in Tonka, and to the villages, Rak, and Ning Khola in Ghunka season.

The monastery and the monks play an important role in the conservation of natural resources and imparting a conservation ethos among the people.

c) Key points/messages of the case relevant to IPBES

- Indigenous system of management of natural resources effectively contribute to conservation of biological and cultural diversity.
- Customary arrangements enable informal local and community-based institutions to effectively manage pasturelands in the Kailash region of Nepal.
- The monastery and monks play an important role in the conservation of natural resources and imparting a conservation ethos among the people.

d) Website or other sources of information

www.icimod.org

www.turecast.edu.np

e) Additional Authors and Key Contributors

Dr. Govinda Basnet, PO Box 24043, Kathmandu, Nepal

f) Relevant literature, documents, videos or other recorded sources of information

ICIMOD/GoN/UNEP (2011) Feasibility assessment report of Kailash Sacred Landscape Conservation-China, India and Nepal (Eds.: KP Oli, R. Zomer). International Centre for Integrated Mountain Development, Government of Nepal and United Nations Environment Program.

Oli, K.P., Rana, P.S.J., Peili, S., Rawal, R.S., Chaudhary, R.P. (2012) Caring for our transboundary landscape – Illustrations from the Kailash sacred landscape. International Centre for

Integrated Mountain Development (ICIMOD), Kathmandu, Nepal.

Rawat, G.S., Rawal, R.B., Chaudhary, R.P., Peili, S. (2013) Strategies for the management of high-altitude rangelands and their interfaces in the Kailash Sacred landscape. In: High-altitude rangelands and their interfaces in the Hindu Kush Himalayas (Eds.: Wu Ning, Rawat, G.S., Joshi, S., Ismail, M., Sharma, E.), p. 25-36, Kathmandu: ICIMOD.

g) About the ILK described in your recommended references

Resource management and indigenous knowledge.

2.12 Bioprospecting of Plant Resources for Validation of Indigenous Knowledge and Search for Novel Herbal Drugs in Nepal

a) Author(s), affiliation and contact

Dr. Krishna Kumar Shrestha

Ethnobotanical Society Nepal (ESON)

Kathmandu, Nepal

Email: kk.shrestha@eson.org.np, kkshrestha123@gmail.com

b) Summary

Nature has been carrying out its own combinatorial chemistry for over three billion years. Medicinal plants rich in phytochemicals have been used for centuries in the treatment and prevention of diseases including drugs for cancer, neurological, cardiovascular, metabolic and immunological diseases, and genetic disorders. The World Health Organization (WHO) has estimated that almost 80% of the world's population relies on traditional medicine for primary health issues.

Nepal contains about 1,950 species of medicinal plants (about 28% of the local flora), including 1,614 native medicinal species. More than 80% of the rural population of Nepal is reported as users of herbal remedies. Ethnobotany plays a crucial role in the study of traditional medicine as it links nature with culture and traditional knowledge with modern technology.

Citing the richness of medicinal plants and knowledge of the indigenous peoples about the use of the plants as medicine, this project, in collaboration with Korea Research Institute of Bioscience & Biotechnology (KRIBB), has been conducted jointly with Ethnobotanical Society of Nepal (ESON) and Central Department of Biotechnology (CDBT), Tribhuvan University, Nepal.

The project site, Dhading District is situated in central Nepal comprising a mixed population of Tamang, Gurung, Brahmin, Chhetri, and Newar ethnic communities. The elevation of the study sites ranges from 500m to 3000m above sea level with a warm subtropical climate in areas below 1000m and a freezing climate in the north. These extreme climatic contrasts within these places are associated with tremendous differences in elevation, topography, precipitation and vegetation. The underutilised plants from the north-west part of the district comprising six village development committees (Salyantar, Budhathum, Aagainchok, Mulpani, Baseri and Phulkharka) were documented for the validation of indigenous knowledge and finding out potential species for novel herbal drug development.

Plants were selected on the basis of their ethnomedicinal importance focused on underutilised medicinal plants. Medicinal importance of the plants were documented from the primary as well as secondary data. Primary data were collected from the community meetings, personal interviews and focused group discussions, involving the Indigenous Local Knowledge (ILK) holders. Secondary data were collected from various ethnobotanical literature, primarily on ethnobotany of Nepal. During the field study, we documented habitat features, photography of plants and plant parts, prepared herbarium specimens and collected plant samples of about 200 species of ethnobotanically important plants. We analyzed bioprospects of 24 species of important plants in the first phase of the investigation.

The investigations were carried out in the laboratories of collaborators in Nepal and Korea. Phytochemical screening of methanol extracts for phenolic and flavonoid content determination for 24 species of plants, and in vitro examination for antioxidant, antibacterial and cytotoxicity in Human cervical cancer cells (HeLa) of plant extracts were also carried out in Nepal.

Among the tested species *Scurrula elata* has potential antimicrobial, antioxidant properties, and remarkable phenolic and flavonoid content. Other potential species having such properties are *Terminalia bellerica* (antimicrobial, antioxidant, phenolic content), *Tsuga dumosa* (antimicrobial, antioxidant, phenolic content), *Geranium wallichianum* (antioxidant, phenolic content, flavonoid content), *Phyllanthus emblica* (antioxidant, phenolic content, flavonoid content), and *Desmodium gangeticum* (antioxidant, phenolic content). Similarly, the highest inhibition of HeLa cell was shown by *Symplocos lucida*. Other potential species include *Desmodium heterocarpon*, *Hydrocotyle nepalensis*, *Hypericum japonicum*, *Maclura cochinchinensis*, *Rhododendron lepidotum*, and *Urena lobata*.

Furthermore, 178 species were assessed for anti-inflammatory response in RAW 264.7 cells, cytotoxicity in six human cancer cell lines and insecticidal potential. Investigation of Human promyelocytic leukemia (HL-60), Human stomach cancer cell (SNU-1), Human fibrosarcoma (HT-1080), Human lung adenocarcinoma (A-549), Human breast cancer cell (MCF-7), Human hepatoma (HepG2), and anti-inflammatory and insecticidal assays were carried out at the Korea Research Institute of Bioscience & Biotechnology (KRIBB), Korea. Among the plant species 16 species showed cytotoxicity in various cancer cell lines, 12 species showed significant anti-inflammatory response; and larvicidal effect was shown by 14 plant species on *Aedes aegypti* (Yellow fever mosquito).

Hence, the results obtained from the underutilized medicinal plants were encouraging, which points to the urgent need for further research to record indigenous knowledge for bioprospecting of Nepalese plant resources. In response to the current degradation of habitat and climate change

there is an urgent need for research to validate indigenous and local knowledge, isolation and characterization of bioactive components, and to find out potential species for novel herbal drug development.

To achieve the national goal for the bioprospecting of underutilised and less-known potential ethno-medicinal plant resources, emphasis should be given to infrastructure development, capacity building/training, exchange visits and publications, as well as organising conferences and training workshops at regular intervals. Similarly, collaboration should be extended for initiating mechanism for sustainable harvesting, *in-situ* and *ex-situ* conservation of economically potential indigenous species, development of high value added natural drugs or nutraceuticals, ensuring Patent Rights (PR), and honoring Intellectual Property Right (IPR), with the mission of equitable sharing of benefits for community development, leading to economic development of developing country like Nepal.

c) Key points/messages of the case relevant to IPBES

- Research to document indigenous knowledge for bioprospecting of plant resources should be given priority.
- Validation of traditional knowledge should be done using modern technology in research laboratories.
- Emphasis should be given mainly on infrastructure development, capacity building, and exchange of visits for collaborating institutions to strengthen bioprospecting research.
- Proper mechanisms should be implemented for Intellectual Property Rights, Patent Rights and fair benefit sharing among key stakeholders.

d) Website or other sources of information

Ethnobotanical Society of Nepal (www.eson.org.np)
Central Department of Biotechnology, Tribhuvan University (www.biotechtu.edu.np)
Korea Research Institute of Bioresources and Biotechnology (www.kribb.re.kr/eng)

e) Additional Authors and Key Contributors

Prof. Dr. Krishna Das Manandhar (Central Department of Biotechnology, Tribhuvan University)
Dr. Sangho Choi (Korea Research Institute of Bioresources and Biotechnology, Korea)
Dr. Sabina Shrestha (Life Member, Ethnobotanical Society of Nepal)
Mr. Yadu Nath Poudel (Central Department of Botany, Tribhuvan University)

Mr. Gyandra Prasad Ghimire (Central Department of Biotechnology, Tribhuvan University)

f) Relevant literature, documents, videos or other recorded sources of information

1. Manandhar NP (2002) Plants and People of Nepal. Timber Press, Oregon, USA.

2. Paudel YN (2015) Phytochemical screening, Antioxidant and Antibacterial Activity of some Underutilized Medicinal Plants of Dhading District, Nepal. Master's Dissertation submitted to Central Department of Botany, Tribhuvan University, Kirtipur (Supervisors: KK Shrestha and KD Manandhar)

3. Shrestha KK, Manandhar KD, Shrestha I., Paudel YN, Joshi S, Rijal B, Tiwari NN, Rajbhandary S, Malla R., Poudeyal, MR. (2014) Bioprospecting on Biological Materials of Nepal (Phase 3). Report submitted to Korea Research Institute of Bioresources and Biotechnology, Korea. Ethnobotanical Society of Nepal, Kathmandu, Nepal.

4. Shrestha S., Park JH, Cho JG, Lee DY, Jeong RH, Han JT, Cho SK, Lee DS, Baek NI. (2016) Phytochemical Constituents of the *Urena lobata* fruit. *Chemistry of Natural Compounds,* **52**(1), 178-180.

g) About the ILK described in your recommended references

2.13 Biodiversity conservation through sustainable use of Tharu Indigenous Knowledge and Its practices

a) Author(s), affiliation and contact

Dr. Gopal Dahit

Tharu Indigenous NGO Federation, Bardia, Nepal

Email: gopaldahit.nepal@gmail.com; dahitgopal@yahoo.com

b) Summary

Tharus are the indigenous people of the plains (Tarai) of Nepal, making up the majority of the population. They have traditional practices of using medicinal plant species for medical cures for sick people and for crops too. Nowadays, because of different threats, the existence and practices of the Tharus are challenging. The traditional medicinal practitioners are called "Baidawa". Such practitioners are decreasing in number at present. With the financial support of the Global Environment Fund/Small Grant Fund, "Biodiversity conservation through sustainable use of Tharus Medicinal Plant Species and its practices" project was conducted in the western part of Nepal. It was conducted from 2011 to 2013 as a pilot project, and successfully completed. There are more than 2000 plant species medicinally used by the Tharus, but detailed knowledge of use is gradually vanishing. During the project period, detailed feature and medical use of 500 plants species were documented, but there is still a lot of scope to work on the project. There is also a need to revive ‘Traditional Medicinal Practitioners’ and enhance capacity building. Policy intervention is also another important part to be enable the conservation of knowledge of the Tharus and the resources they use.

c) Key points/messages of the case relevant to IPBES

- The Tharus indigenous peoples have practiced medicinal plants to treat diseases and ailments prescribed by the local healers.
- The knowledge regarding use of natural resources has been vanishing and there is a need to revive the knowledge.
- In order to protect and utilise this valuable indigenous health care knowledge, systematic documentation using digital technologies should be supported;
- Proper policy, institutional and capacity building and financial support should be provided by the Government to protect, promote and utilise this knowledge;

- The medicinal plants used by Tharu Baidwas should be conserved by involving Tharu community in community forests, protected areas and national forests.

d) Website or other sources of information

www.unycnepal.org.np

www.gefsgp/nepal

e) Additional Authors and Key Contributors

Published two books. "Tharu Indigenous Knowledge and its practices", Part 1 and Part 2. They document about 500 species of Tharu Medicinal plants. Both books were edited and compiled by Dr. Gopal Dahit.

f) Relevant literature, documents, videos or other recorded sources of information

There is a movie and a book, but these are not uploaded onto the internet. If necessary, we can provide hard copies of these.

g) About the ILK described in your recommended references

The government of Nepal should give legal authority to practice the Tharus traditional knowledge of using medicinal plants species for medicinal purposes. All this knowledge should be documented properly and given community ownership as well. This knowledge can be the best source of income for the Tharus. Therefore, national and international organisations and government should give priority to this.

3. Summary of discussion

This chapter summarises the discussions during the dialogue workshop under four sections, i.e. (1) inauguration and introduction, (2) presentation and dialogue session of selected ILK case studies, (3) chapter-wise writing session as well as (4) discussions about the concept of the establishment of ILK network for South and West Asia sub-region. The discussion on the second section (ILK case studies) was presented by the case studies submitted by the selected ILK holders and experts as presented in Chapter 2. The discussion under the fourth section referred to the note from IGES presented in Chapter 4.

30 November 2016 (Wednesday)

3.1 Inauguration

The inauguration of the workshop commenced with a welcome ceremony for the Chief Guest Dr. Bishwa Nath Oli, Secretary for the Ministry of Population and Environment, Nepal (MoPE), who received a bouquet.

Mr. Durga Prasad Pandey (Executive Director, ReCAST), gave the welcome remarks. He said he was pleased to welcome all the participants of the IPBES South and West Asia Sub-Regional Dialogue Workshop. The Research Centre for Applied Science and Technology (ReCAST) was established in 1977 in Tribhuvan University, and served as the Secretariat of the National Council of Science and Technology of Nepal. He expressed his hope for a fruitful workshop and collaboration between ReCAST and IGES.

Mr. Yoichi Sakurai (IGES, the project manager of the Japan Biodiversity Fund Team), expressed his deepest gratitude. He presented the objective of the workshop and how to link science and ILK, and policy and science, as well as how to link biodiversity and ILK with policymaking.

The Workshop was then formally opened by the Chief Guest, by lighting the *'Panas'* (traditional oil lamp).

Prof. Ram Prasad Chaudhary (ReCAST), welcomed all the participants on behalf of ReCAST and the organisation committee. He expressed his gratitude to the sponsors of the workshop. He mentioned that IPBES is conducting an assessment of biodiversity and Ecosystem Services (ES). If we consider biodiversity and ES as assets of the Asia-Pacific region, it is one of the richest in the world. He outlined the threats that biodiversity and ecosystem services are facing. He also thanked

the local organisations which participated in a meeting prior to the first day of the workshop. Dr Chaudhary outlined the schedule, and expressed his hope that the outcome of the workshop will also contribute to the implementation of the new constitution of 2015 in Nepal, which provides for public access to natural resources.

Dr. Madhav Karki (Co-chair of the IPBES commissioned Regional Assessment of Biodiversity and Ecosystem Services, CGED-Nepal) presented the context, background, and objective of the dialogue. He said that IPBES is equivalent to the IPCC, providing policy support, tools and methodologies. It supports capacity building efforts. In today's diverse and changing contexts it provides different types and sources of knowledge. IPBES feels that ILK is important to provide a strategy for the solution that ecosystems and biodiversity are facing. For this purpose, IPBES has set up a Taskforce with three objectives: (i) approaches to work on ILK, (ii) support of and facilitation on how ILK can be brought into the IPBES assessment, and (iii) review of existing ILK knowledge.

IPBES is conducting four regional assessments, three thematic assessments and a global biodiversity assessment. There have been three sub-regional workshops. The scientific assessment needs to include quotations and citations. As the Co-chair of the IPBES assessment, the literature that will be provided to the authors will be the basis to elaborate policy-relevant messages.

Dr. Bishwa Nath Oli (Secretary, Ministry of Population and Environment of Nepal), gave the Opening Speech. He welcomed all participants to the workshop and thanked IPBES, IGES, and ReCAST. He said it was an honour and privilege to provide the opening remarks for this workshop. He pointed out that Nepal's ILK-based hill farm systems have a significant similarity with Japan's socio-ecological Satoyama landscapes. Biological conservation has developed in Nepal and sustains livelihoods. However, due to climate change and other threats, local communities have become increasingly vulnerable. A high rate of poverty and inequity has contributed to increasing vulnerability. The studies supported by our Ministry, have shown that integrated natural resource and management practices are key to address this vulnerability. Indigenous and local knowledge, as well as supportive policies, institutions and capacity building need to be strengthened. Tenure security needs to be in place. The Government of Nepal allows local communities to manage forest resources in a sustainable manner, which supports livelihood generating activities. IPBES should provide local organisations with opportunities to contribute their ILK. Dr. Oli reiterated the commitment of his Ministry to IPBES.

Dr. Krishna K. Shrestha (President, ESON) gave the vote of thanks, expressing his gratitude to Mr. Yoichi Sakurai and the JBF team for their contribution to the workshop, to Dr. Durga Prasad Pandey and Dr. Ram Prasad Chaudhary for their support, and to Dr. Madhav Karki for his co-ordination, and the Nepal IPBES focal point, Mr. Rajubabu Pudasaini, Ministry of Population and Environment, as well as the authors of the assessment, ILK holders, ILK experts, for attending the workshop. Similarly he extended thanks to the Organizing Committee members, staff of ReCAST, and Hotel Mountain View Dhulikhel for their cooperation.

3.2 Introduction of the objective and programme of the workshop

Mr. Wataru Suzuki thanked the organising team and delivered a brief presentation on IPBES. He mentioned the overall goal of IPBES, which is to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development. The Platform was established in Panama in April 2012 and has 125 members. One of the four functions of IPBES is to deliver global, regional and thematic assessments on biodiversity and ecosystem services. Mr. Suzuki also showed what assessment should look like based on examples from the Millennium Ecosystem Assessment. He summarised the process of international debates on biodiversity and mentioned the pollination assessment as an example of an IPBES report. Finally, he reminded participants of the time schedule of the AP assessment and related events.

Mr. Yoichi Sakurai, Manager of the JBF-IPBES Team, explained the JBF-IPBES Capacity Building Project for the implementation of the IPBES Asia-Pacific Regional Assessment. The Japan Biodiversity Fund (JBF) is provided by the Japanese Government (Ministry of the Environment) and managed by the Secretariat of the CBD (SCBD). The project term is from April 2016- June 2019. The project has three components:

- Component 1: Piloting approaches for bringing ILK into the Asia-Pacific regional Assessment.
- Component 2: Application of outputs from scenario analysis and modelling assessment (Deliverable 3c) to APRA and other regional assessments.
- Component 3: Policy support for decision-makers and stakeholders.

Mr. Sakurai explained that one of the activities under component 1 is to organise dialogue workshops at the sub-regional level, such as this dialogue workshop for South and West Asia.

He also presented the objectives of the workshop:

- Follow up on the outcome of the IPBES ILK WS for Asia-Pacific in Chiang Mai in June 2016 for South and West Asia sub-regions.
- Share ILK cases and provide opportunity to fill the gaps relevant to IPBES Assessment to fill the gaps in terms of regional and thematic aspects.
- Build respect, mutual understanding and network among ILK holders/experts, assessment authors and ILK Taskforce Members.
- Enhance capacity and facilitate the involvement of ILK holders/experts and assessment authors in the IPBES Asia-Pacific Regional Assessment (APRA).
- Provide support to indigenous peoples and local communities for their contributions to conservation and sustainable use of biodiversity.
- Facilitate possible processes of establishing ILK network for South and West sub-regions.

Dr. Madhav Karki presented a summary of the Outcome of the Workshop held in Chiang Mai, Thailand in June 2016. The workshop was the first dialogue meeting where ILK holders, ILK experts and AP Regional Assessment authors exchanged, reflected, reviewed and co-produced knowledge for the AP assessment of Biodiversity and Ecosystem Services. The workshop thus initiated a Dialogue Process which aims to:

- Provide a neutral forum, bringing together relevant knowledge from indigenous & local knowledge holders and ILK experts.
- Provide access to relevant oral knowledge by publishing it as grey literature with prior informed consent.
- Establish a face-to-face dialogue between ILK holders and authors, facilitated by the task force members.
- Develop a rigorous and consistent approach to ILK within the assessment and across assessments (concepts & definitions).
- Build the capacities of both ILK holders and authors.

The main challenges that the Dialogue Process faces and needs to address are: a) that science and ILK are anchored in different ontologies; therefore it is necessary to build synergies between them in an intellectually rigorous and culturally respectful manner; and b) currently there is asymmetry in terms of resources available, and financial and institutional support available to the two knowledge systems that needs to be properly balanced..

Participants of the Dialogue Process have been:

- Indigenous and local knowledge holders & Indigenous and local knowledge experts;
- co-chairs of the Asia Pacific assessment;
- assessment authors; and
- ILK-TF members from Asia-Pacific region and TSU staff.

Methods used include:

- Participatory methodologies including world café and drawing/modelling sessions; and
- Presentations and small group discussions.

The foundations for exchange revolved around the ten case studies brought by the knowledge holders and experts.

3.3 Presentation and dialogue session of selected ILK case studies

Dr. Karki: Seven new stories will be shared (2 from Pakistan, 1 from India, 2 from Iran, and 2 from Nepal).

Dr. Saima Hashim (Associate Professor, University of Agriculture, Peshawar, Pakistan), presented the first study on:

1) Invasive weedy species of Abbotabad District, Pakistan

The study was conducted in the Himalayan district of Abbotabad. In the study background, Ms. Hashim mentioned that urbanisation, extensive trade, migration, reclamation and settlement of new lands, growing of useful plants and development of livestock industry, as well as ecological disturbances, are the factors contributing to the weed invasion.

She referred to Gause's Competitive exclusion principle as a fundamental rule of ecosystems: "The two species occupying the same niche cannot survive simultaneously." She stressed the importance of Article 8(h) of the convention on Biodiversity (CBD) signed by 161 countries at the Earth Summit in 1992 urges the parties to "prevent the introduction of control, or eradicate those alien species which threaten ecosystem, habitat or species".

She explained the negative effects of invasive weeds on biodiversity and indigenous local knowledge. The main issues caused by invasive weeds are that:

- they cannot protect the soil, the way native plants do;

- thus erosion increases which can affect the composition of our local flora & fauna (biodiversity);
- while some are chocking water streams, thus affecting fish population and water quality; and
- enhance risks devastation due to climate change, floods etc.

Dr. Hashim pointed out that the research base on invasive species in Pakistan is very weak. According to an earlier report, of 700 alien species in Pakistan, five or six could be recognised as high-impact invasive species.

These include:

- 'Paper mulberry' (*Broussonetia papyrifera*),
- 'Mesquite' (*Prosopis juliflora*),
- 'Water hyacinth' (*Eicchornia crassipes*), and
- 'Congress grass' (*Parthenium hysterophorus*).

There is a particularly threat from paper mulberry due to health problems in Islamabad and other parts of the country. An example of a rather new emerging but rapidly expanding alien species is *Xanthium strumarium*, whose seeds stick to the cattle. Its invasion was caused by migration from Afghanistan and affects maize cultivation. The main objectives of the study were:

- To document the response of the local community regarding spread and impact of invasive species to be deducted from the list.
- To use the indigenous knowledge of the local communities to cope with the problem of invasive weeds, and
- To suggest suitable solutions regarding management of invasive species.

The main methodology involves an Ethnobotanical approach, and indigenous knowledge of the local communities was employed in the study of invasive weeds. A survey method was used to determine the extent of invasive weeds.

The results of the survey based on the response of 200 farmers was that out of 36 reported weeds, 14 were associated with wheat, 11 with maize, 10 with wastelands and roadside, nine with vegetables and only one with rice. Some of these weeds can be found simultaneously in more than one crop.

Preliminary findings include:

- Legislation exists, but it is not practically enforced. This leads to mismanagement and environmental problems.

- There are very important invasive species. For example, *Robinia pseudoacacia* was introduced by forest department and is now an important invasive tree species in Pakistan.
- The evolutionary changes might have modified the genotypes resulting in more suitable ecotypes for these habitats.

Additional expected outcomes include identifying the farmers' view on change in cropping practices to cope with invasive weeds and developing future collaborative projects.

The second presentation from Pakistan was held by Dr. Muhammad Ibrar Shinwari (Faculty of Basic and Applied Sciences, International Islamic University, Islamabad), on the:

2) Documentation of Indigenous and Local Knowledge on Medicinal Plants in District Rahim Yar Khan of Pakistan

In Pakistan there is considerable biodiversity due to variation in temperature and altitude. There are 18 ecological zones in Pakistan.

The Study Area, the District of Rahim Yar Khan, is located in the south of Punjab province. The climate is hot and dry in the summer (April to October), and cold and dry in the winter season (November to March). The average annual rainfall is about 100mm. The hydrological system depends largely on the Sindh River. There are three geographical zones (Riverine area, 2. Canal irrigated area, and 3. Desert area), and a diverse ethnic background.

The objectives were:

- To document the Indigenous Local Knowledge about medicinal plants and trigger development of a database,
- To report new as well as rarely reported medicinal properties of medicinal plants, and
- To evaluate the medicinal value of the selected plants used by the local people as herbal medicine.

The methodology involved were:

- Ethnobotanical Field/ Market Surveys from October 2015 to November 2016 in four selected sites: The ethnobotanical survey **c**ollected data from 70 local herbalists/ hakims through a Questionnaire and interviews. The market survey of 16 local *Pensar* stores and *Dua Khanas* allowed for the evaluation of the socioeconomic value.
- In addition, the Medicinal Value was evaluated based on two formulas.

The assessment approach kept in mind the socio-economic dimension, which is of great importance and centred between ethnobotany, socioeconomics, people and plants.

The overall results of the 1-year study include:

- About 100 local recipes composed of a total of 78 medicinal plant species were recorded belonging to 33 families and 66 genera at four study sites.
- Indigenous/ local knowledge was documented based on:
  - Local Hakims (71 plant species)
  - Homeopathists (23 plant species)
  - Local people knowledge from Tib-e-Nabvi (11 plant species).

The study also identified four major threats to indigenous local knowledge and ethnobotanical diversity:

1. Conservation Threats (including lack of Indigenous Local Knowledge documentation urbanisation, sustainable utilisation of wild medicinal plants, and habitat degradation).
2. Taxonomic Threats (Nomenclature ambiguities, lack of Indigenous Local Knowledge documentation, and lack of scientific knowledge application).
3. Administrative Threats (unorganised trade, lack of scientific application, quality of raw materials).
4. Physical threats (conservation threats, lack of Indigenous Local Knowledge documentation, urbanisation, sustainable utilisation of wild medicinal plants and habitat degradation).

These issues are common to the whole country. The study has focused on traditional knowledge of local people and also considered the issue of Intellectual Property Rights.

The presentations were followed by a brief Q & A session.

Prof. Chaudhary: How can you deal with the IPRs of the people based on indigenous knowledge?

Dr. Shinwari: It is important to keep in mind IPR to be successful in securing TK.

Prof. Ning: Are there any interesting practices in terms of mitigation?

Dr. Shinwari: Invasive species release agrochemicals, which make become allergens to animals or can cause rashes to humans. Farmers were asked what could be done. There are case-by-case details for each invasive species. They remove invasive species so that native species can grow. If we

develop the charcoal industry, the invasive species *Prosopis glandulosa* can replace a native species. We need evidence further study on how we can use local knowledge.

2) Traditional and local knowledge on invasive species: These are recent issues. Can we say the way local people deal with this invasive species is traditional knowledge?

Dr. Shiwari: Invasive species are a threat to indigenous species and indigenous knowledge.

Dr. Karki: Alien species become a threat if their population rapidly expands and replaces indigenous species. Invasive species have also been important as a food source. If indigenous people find good uses, this reduces the threat to ecosystems and local livelihoods, which is important.

Mr. Pudaisani commented regarding the policy perspective: How did we get the knowledge, and what are its implications? This needs to be more elaborated so it can have policy implications. Regarding Muhammad's presentation, it is important to elaborate how knowledge has been generated.

After the Q & A on the presentations from Pakistan, Prof. Brajesh K. Tiwari (Department of Environmental Studies, North-Eastern Hill University, Shillong, India), presented on:

3) Traditional Knowledge Based Natural Resource Management Systems of North East India

Prof. Tiwari considers that the term "indigenous" is not a proper term for India, as we consider all Indians indigenous. Therefore he prefers to use the term traditional knowledge which is synonymous with ILK as used for other parts of the world. There is immense cultural diversity in the Northeast of India with more than 200 ethnic groups each with their distinct culture and dialect/language. The region harbours 50% of India's biodiversity and has high endemism. Northeast India is very rich in traditional knowledge and several communities manage their Natural Resources using this knowledge. The TK based Natural Resource Management is prevalent throughout the region. There is a typical hierarchy of traditional institutions of Meghalaya which connects the family with clan; clan with village chief; village chief with group of village chiefs, and group of village chiefs with the chief of the territory. The general body of each institution comprises all adult members of the territory as the final decision-making body. These traditional institutions are custodian of culture and tradition of the people. The tribal people of the state have classified forests based on their experienced learning and traditional knowledge. Each forest type has a distinct role, purpose and customary rule for their management.

About 75% of forests are community forests in NE India. Each tribe in the region has evolved their own situation-based forest management practice. The community forest of Meghalaya consists of four forest types: Village forests, Group of village forests, Clan forests, and Sacred forests. Conservation of forests by traditional societies with otherwise fragile ecosystems is done for various reasons, such as for water provision, cash income and religious and cultural reasons.

Management interventions, include social fencing, are based on selective extraction/felling, fire lines and controlled grazing.

A number of traditional societies have sacred groves in their villages. Sacred groves (SG) are mostly large patches of forests protected by the people based on religious beliefs, hence more appropriately called sacred forests. The study has documented hundreds of sacred groves or forests of Meghalaya; ranging from 0.5 to 900 ha. Sacred groves have a high phytodiversity conservation value; these are often the only places in the village where biodiversity is conserved. In a study on inventory of plant species of sacred groves we recorded that 133 plant species were found only in SGs out of which 96 are endemic to Meghalaya. The sacred groves and other forests protected by the tribal people have an important function for conservation of biodiversity watershed protection.

Based on their traditional knowledge some societies have evolved a site specific land use practice. These land use systems are based on their traditional knowledge (TK) and are most suited to the physiography and climatic conditions of the place. In this system the Khasi people of south Meghalaya maintain a forest patch near human habitation which is generally on top of the hill. The pastures are maintained on the upper hill slopes while steeper slopes downhill are kept under agroforests.

These people have also a well-established TK based health care systems which include herbal practitioners, who collect medicinal plants from the forests and agroforests. The local people, on the other hand, protect the forests and maintain agroforests which are open for collection of herbs by the local health practitioners.

The study also compared TK-based natural resource management with modern natural resource management systems. The results suggest that TK-based natural resource management is more sustainable, is based on local needs and leads to less conflicts than modern systems.

A creative integration of TK-based technologies with modern management systems is leading to livelihood improvement of communities of north-eastern India.

Important points learned include:

- Traditional knowledge helps in conservation of natural resources. Most of natural resource in NE India are preserved because of traditional knowledge available from the people.
- Traditional knowledge is dynamic, and people are constantly innovating in order to make it suitable to the changing needs of society.
- Natural resources and TK are interrelated and interdependent for perpetual existence. Therefore conservation of traditional knowledge is important for conservation of natural resources.
- TK-based NRM is based on the wisdom held and shared by the community, and passed down from generation to generation and thus time tested.
- TK-based management is more inclusive, equitable and therefore sustainable.
- Traditional land use and production systems are often more appropriate for the local environment and conditions than technologies suggested by outside experts.
- Traditional management systems need to be judiciously blended with modern principles of conservation and management of natural resources.
- Traditional systems are under pressure, but still quite effective.

Dr. Madhav Karki emphasised that Prof. Tiwari provided a valuable source of publications for the authors to refer to.

The presentation was followed by a brief Q & A session.

Which area has the most ancient knowledge? Have there been shifts from one place to another? Which area can be taken as a model for TK so that authors can focus on it?

Prof. Tiwari: NE India is culturally and geographically more related to SE Asia. Every tribe, locality, and subregion has developed its own knowledge system. People were geographically isolated; and so many practices have been indigenously developed.

How are communities getting benefits from SG? There are SG with low levels of extraction.

Prof. Tiwari: There are different hierarchies of access. These range from open extraction, restricted extraction (with permission of local institutions), and completely protected areas. All three types can be found within a small area, and provide different services to people, such as water provision and religious or cultural values.

Dr. Karki: This brings us to the concept of multiple values. There are economic values, but also intrinsic values, and conservation for future generations. Importance of institutions: If institutions vanish, knowledge will vanish. Knowledge and institutions need to co-exist. In Nepal, there is the example of the Guthi system, a social organisation that is used to maintain the socio-economic order of Newar society.

The afternoon session was facilitated by Dr. Krishna K. Shrestha. It included three presentations from Nepal.

Mr Bijay Raj Subedee (Ph.D. Scholar, ReCAST, Tribhuvan University), presented on:

4) Cultural and Economic Value of Himalayan Giant Nettle (*Girardinia diversifolia*) in Eastern and Western Regions of Nepal

Himalyan Giant Nettle or '*allo'* in Nepali, is a fibre bearing plant species and used as a sacred plant in Kulung Rai in Sankhuwasabaha District.

The objective of the study was to document cultural and economic importance of *Girardinia diversifolia* in eastern and far-western regions of Nepal. The methodology included: Focus group discussion, informal meetings, field observations and semi-structured questionnaires.

Indigenous peoples and local community (IPLCs) such as Kulung Rai from Sankhuwasabaha District use *allo's* fibre since ancient times, as material for porter straps (*Namlo*), ropes for domesticated animals ('*Damlo'*), and for coats, pants, bags, shawls, purses and many more items. Other parts of the plant are traditionally used by local healers (*Baidhya* and *Dhami*).

Local people use this NTFP following traditional practices for processing methods:

- Collection, binding, cooking, spinning (traditional spinning machine 'Charkha')
- Hand spindle ('Katuwa') and wooden hammer ('Mungro') are also still in practice
- White clay soil ('Kamero') is used for softening the fibre

However, 85% of respondents have stated that natural habitat is decreasing day by day. The causes of the declining Himalayan Giant nettle population include: a decrease of livestock domestication and planting of cardamom on the same land where *allo* grows.

Allo still provides income generation for diverse types of local people in production, trading and consumption. *Allo* has changed the perspectives of women away from only kitchen activities.

Girardinia diversifolia also has a cultural use during pregnancy, and at marriage ceremonies, when its fibre is burnt to keep away evil spirits. The use of *allo* is combined with the use of traditional natural dyes produced from *Rubia manjith* for special rituals.

Communities are involved in sustainable management, and have their own rules to ensure the sustainable management of Himalayan Giant nettle. There is a particular month and date for harvesting *allo* from the forest. When harvesting, the rule is to leave 4 inches of the stem above the ground. Members of modern local organisations such as Community Forest User Groups and Village Development Committee follow the collection rules.

The proposed way forward involves:

- Recognition and sustainable use of ILK with respect to ILK holders is an important need and concern for the management of *Girardinia diversifolia*.
- Need for a clear policy for marketing of finished products.
- Use of modern techniques and machines in spinning and weaving methods.

Mr. Subedee's presentation was followed by a presentation held by Mr Shiva Devkota (PhD. Scholar, WSL, Switzerland) from Pokhara, Kaski District on:

5) Indigenous and Local Knowledge (ILK) on Mushrooms, Lichens and Caterpillar Fungus (Yarsagumba) in Nepal Himalaya

Mr. Shiva Devkota said he is interested in traditional knowledge on biological resources and at most forums, he is the only researcher to present on mushrooms and lichens in Nepal. He has explored areas mostly in central and eastern Nepal.

'Mushroom lovers' in Nepal are largely indigenous people: Tamangs, Magars, Thakalis, Newars, Sherpas and Chepangs. In Mustang, Dolpa and other mountainous areas, mushrooms are important commodities in local markets sale and used in restaurants. The study team interacted with farmers, men and women, children and documented their knowledge, including after poisoning cases of community members. Researchers studied poisonous mushrooms with the help of local people.

When documenting the traditional knowledge of mushrooms, it is difficult to categorise edible and poisonous mushrooms based on traditional knowledge. Traditional knowledge is not 100% correct, as there are general beliefs which are false (e.g. "all mushrooms growing on live trees are edible?").

Correct knowledge to minimise poisoning include:

- Avoid unknown species;
- Boil mushrooms in mild salt water, turmeric;
- Powder before cooking; and
- Do not store long time in plastic bags/containers.

Lichen is an even more neglected study field in Nepal. There are several values of lichens. For example, the *Limbu* community produces lichen sausage. Lichen is much preferred as food and for rituals by Limbus, Rais and Tamangs, as they are indigenous peoples of Eastern Nepal.

Particularly widely known and most valuable organism is the Caterpillar Fungus (Local language: *Yarsagumba*) (*Ophiocordyceps sinensis*), which grows on caterpillars. Local people think this are very useful fungi. They have an extremely high economic value: USD 20,000 / kg in Kathmandu. According to modern science-based research, the fungi's effects include: Anti-cancer, anti-viral, reduction of cholesterol, increase of stamina, etc. In Nepal it is also prescribed as sexual stimulant, and is used as a cure for diarrhoea, headaches, coughs and rheumatism.

After Mr. Devkota's presentation, Prof. Krishna K. Shrestha introduced Dr. Ganesh Raj Joshi (Honourable Commissioner, CIAA, Nepal). This was followed by Q and A on both presentations from Nepal.

Prof. Rawat commented: For most lichens in India, people do not reveal their uses, and theya re provided to traders who also do not reveal the uses. Traders buy at a very low price and sell at much higher prices. So, local people have very low economic benefits but still trade the lichen.

Dr. Shinwari commented: Lichens are totally ignored in Pakistan. He asked to what extent baseline data are available in Nepal and India, and whether there are cultivation techniques available?

Mr. Devkota: In the western part of Nepal people are interested in trade, in eastern part the lichen are mainly for local consumption. In the eastern part, we found three species of lichens that are used, in the western part there are 21 species traded. In 2011, 600 metric tonnes of lichens were exported to India. The baseline data of lichens comprises 724 species of lichens in Nepal. Research on lichens is ongoing, expecting to reach probably 1500 species of identified lichens.

He also clarified that the species under the **Amanita** genus is poisonous in Nepal, and not used for AIDS treatment.

Dr. Karki: Following these five presentations of new case studies, and the presentations already made at Chiang Mai; all these presentations will be made again for validation in summary form.

Next, Mr Saeid Nouri Neshat, Boompajuhan Society, Iran, presented:

6) "Qanat, a Traditional Irrigation System in Iran"

After the Chiang Mai workshop, a one-day workshop was held on 18 September 2016 in Kerman city including mugannis ("well diggers"). The results of this workshop were presented.

The definition of Qanat is a physical definition. There are more than 25,000 Qanats in Iran. 'Qanat' is "an underground gallery that conveys water from an aquifer or a water source to less elevated areas. In practice, a Qanat consists of a series of vertical shafts in sloping ground, interconnected at the bottom by a tunnel with a gradient that is gentler than that of the ground. The first shaft (mother well) is sunk, usually into an alluvial fan, to a level below the groundwater table. Shafts are sunk at intervals of 20 to 200 meters in a line between the groundwater recharge zone and the irrigated land. From the air, a Qanat system looks like a line of anthills leading from the foothills across the desert to the greenery of an irrigated settlement."

Qanats create a reliable supply of water for human settlements and irrigation in hot, arid and semi-arid climates. Qanats are expensive to construct, but have a long-term value to the community.

The UNESCO World Heritage Committee, in its 40th meeting in Turkey, inscribed eleven qanats in Iran in the list of World Heritage Sites that have been documented dating back between 200 and 2500 years ago.

There are five important issues that were ignored in Chiang Mai, but were raised and discussed in Kerman workshop:

i. Qanat and ecosystems: Environmentally-friendly technique and a suitable way for the conservation of water resources. There are many challenges: Due to deep wells the level of underground water is decreasing in desert areas in Iran.
ii. Qanat and livelihoods: Tangible aspects and intangible aspects mostly managed by women.
iii. Qanat Management, which is an important challenge.
iv. Qanat and women participation: Increased solidarity of women and participatory Management of Qanat.

v. The Qanat system and policy-making: There is no major policy on conservation of Qanats, and existing policies that affect Qanats are contradictory. In addition, these traditional and local management systems have not been recognized nationally.

Dr. Karki: Has climate change had any impact?

Mr. Neshat: Climate change has had an impact in Iran and on Qanats in the form of increasing droughts.

Ms. Bahar Mohamadifar, in collaboration with Mr. Neshat, delivered a presentation on:

7) Local knowledge of Nomads in Sustainable Management of Pastures in TangeSayad –Sabzkouh Biosphere Reserve, Iran

Her research team engaged in an action research project with nomadic herders in Iran and helped them register the local knowledge on pastoral management region in Iran as a nomad management system under UNESCO.

There are three large nomad tribes in the western mountain range of Iran. Each tribe is composed of different sub-tribes, clans and families. It is a dog-bone system. In the winter they are on the south facing slopes, three months in the summer season, and three months in the winter season.

There is very local knowledge on how to manage the grazing. Local knowledge based protection is to prevent herds from early entrance to pasture when plants are blossoming.

The adoption of the Land Reform Act in 1962 led to government ownership of the land used by nomadic herders and to the settlement of nomads. As a result, the tribal system has significantly weakened. However, more recently, the government has started to issue licences for grazing.

The settlements of nomads include both endogenous settlement and planned settlement. This has led to several challenges. To solve these strategies for interaction between pasture management in local and formal styles have been proposed. One finding was that there is a need for local groups of protectors, who pursue environmentally-friendly approaches. Cooperatives can play an important role in collecting and registering the local knowledge of nomads.

Next, Mr Robert Panipilla (Friends of Marine Life (FML), Kerala, India) made presentation on:

8) Mukkuva Community of South India

The fisheries-based Christian Mukkuva Community is spread over in the Indian states of Kerala, Tamil Nadu and Andhra Pradesh, but also in Sri Lanka. Along its 590 km coastline, the State of Kerala, has nine coastal districts with 222 marine fishing villages, where more than 120,000 fishing households exist. The study was focused on the Mukkuva community in Trivandrum District of Kerala. The community's name derives from "mukku" (corner), which means people living around the southern corner or tip of India. Information from ILK holders was collected during interviews with different experts and focus group discussions after the Chiang Mai workshop.

In terms of activities, generally men engage in fishing, while women are responsible for fish vending. Limited knowledge is available about *bio-cultural diversity* of Mukkuva community:

- The history and socio-cultural traditions and livelihood are closely connected with the Marine ecosystem services.
- There is a strong evidence for an inseparable connection between the Mukkuva community and marine ecosystem services.
- Ocean and marine environment has become an integral part of the history and upbringing of the community.
- The coastal language is also evolved through this interconnection. Coastal language/the community language contains many aspects of marine ecology, especially seabed ecosystems. However, the language has not been given enough attention, because Malayalam (the regional language of Kerala) is considered to be the official language. Over the years, the language has lost many speakers, and ecological knowledge as well.

Traditional marine fishery knowledge and practices have determined the development of fisheries of the Mukkuva Community:

- Coastal areas have developed as the most important places of fishing activities where there is presence of reef ecosystems on the seabed.
- There is thus a strong link between geo-physical morphology of the seabed and the socio-cultural history of the Mukkuva community. Traditional knowledge includes traditional techniques of locating seabed areas (*Kanicham*).
- Community fishermen know well about the ocean currents, wind systems as well as their seasonal nature, and how these influence life patterns in the ocean.
- Astronomy has also been traditionally important, as stars and constellations used by fishermen for their livelihood related travel, and locating seabed ecosystems.

Introduction of modern fisheries technology has been the most important change that has taken place since the 1960s with the use of trawlers and purse seine. Both have turned out to be destructive technologies. However, the Mukkuva community unanimously refused this technology based on their knowledge about seabed ecology.

Since the 1980's motorisation of traditional craft has taken place. It mainly aimed at helping traditional fishermen to fish in deep waters. Their Catamarans (*Kattamaram*) were replaced by plywood boats and sails replaced by outboard motors. However, the motorisation led to large investments and the fishermen have encountered difficulties to cover daily running expenses.

Government legislations and polices promote mechanisation causing the destruction of Mukkuva's traditional fishing grounds. Most government projects are focused on mechanisation and motorisation which requires large investments. A minority of Mukkuva fishermen have recently started to embrace mechanised vessels. As the traditional fisheries cannot be run from their own villages, fishermen and female fish vendors are not able to continue their livelihood practices within their villages and are compelled to move to harbour areas, which is leading to new socio-economic issues. Recent challenges include:

- Compared to the protection of 10,000 km^2 land that have already been identified as eco sensitive areas (ESA) of Kerala, its 3,000 km^2 of coastal and marine environment still need to be identified as Eco Sensitive Seabed Areas.
- The community which has real knowledge about seabed ecosystems has not been consulted or encouraged to participate in any study related to Kerala's marine and coastal environment.
- It is also very important to understand the ecological perspective of community history, and that the marine and coastal ecological knowledge is embedded in the language of Mukkuva.
- Irregularity of seasons and changing climatic conditions create challenges for Mukkuva's fishing practices.

However, there are also indications that the Mukkuva community, which represents 42% of fisher folk of Kerala and do not use destructive technologies, contribute to Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources.

Dr. Karki: The key messages from this study include that the Mukkuva have developed some model technologies based on traditional knowledge.

After that, Mr. Davidson Sargunam Selvanayagam from the Tribal Foundation, Tamil Nadu, India, presented on:

9) Sustainable Resource Use and Forest Conservation by the Kaani Indigenous Community of Kanyakumari Forests in the Western Ghats

The Kanyakumari forests are located at the Southern-most tip of India in the tail-end Western Ghats, a biodiversity hotspot and UNESCO Heritage Center. The district has 30.2 % of forests in the total area, and hosts 14 types of forests, as well as rich biodiversity (including elephant, tiger, leopard, cobra, king cobra), medicinal herbs and eco-tourism spots.

The Kaani indigenous people dwell in 48 settlements in the hills and forests. Many settlements can only be reached by ferry, or long and strenuous forest walks. The indigenous community lives in consonance with nature, deriving everything from forest resources for their livelihoods. The forests provide food sources, fodder and fuel wood. Food culture has evolved around tapioca (one of the staple foods). Community members include animists who worship nature. Many reject modern medicines and vaccines. Instead they believe in benevolent and malevolent spirits. As animists, local communities traditionally do not harm animals, which is a positive driver in fauna conservation.

However, the area is seeing increasing forest destruction, monoculture rubber plantation, forest encroachment, damage to elephant corridors, imbalance in predator-prey population ratio, and drought conditions as a result of climate change. This has contributed to a heavy proliferation of wild boar, monkey, sambar deer and barking deer. As a result of these impacts, agricultural crops are increasingly damaged and destroyed, which is leading to human – wildlife conflicts. There are innovations in local knowledge such as the use of DVDs to reflect light and scare away animals.

Fish tail palms are used in rituals, but this has led to overuse. Therefore, *in situ* cultivation is practiced as part of the Tribal Foundation's activities. The same concept is applied to mushroom cultivation. The Foundation advises not to overharvest in the forest, but to cultivate. *Zingiber zerumbet* provides organic shampoo. More than 600 medicinal plants are used in the area.

The Tribal Foundation strives for environmental conservation through the development of education, social, economic, cultural, and environmental spheres of the indigenous communities. The Foundation imparts environmental awareness to reduce the community's dependence on forest resources and reduce the footprints on forests.

The presentations were followed by a brief Q & A session:

Dr. Shinwari: There is a corner in which ILK is hidden and that should be explored. Look into folk songs and folk poetry.

Dr. Karki: ILK is not only spoken language, it is also expressed through art and other cultural performance. It has different types of expressions – both oral and visual.

Q: Modern fishery technologies are destroying livelihoods. Do you recommend returning to traditional practices?

Mr. Robert Panipilla: Modernisation, especially mechanisation of the trawlers, does not allow for sustainable fisheries. There is no study on Kerala seabed ecosystem. The mechanisation has destroyed the seabed ecosystem. Mechanisation and motorisation have damaged seabed and livelihoods. There are some *Ketuwan* (traditional songs of fishermen), which include the names of seabeds and marine species. Fishermen used to sing these songs when they were alone on the deep sea.

Mr. Davidson: Stories and songs are based on forest ecosystems. It takes a lot of time to translate these into other languages.

Dr. Karki: Facilitators will plan the organisation of next session, where authors will present their needs and to what extent the presentations contribute to their needs.

Next, Dr Madhav Karki presented on:

10) Integration of Different Knowledge Systems

The coexistence of multiple knowledge and value systems indicates the need for integration.

The main characteristics of ILK are that it is local, usually undocumented but implicit knowledge, which is transmitted from peer-to-peer, and tested and tried for generations. It is therefore dynamic and transformative and includes both experiential and practical knowledge. It is associated with a climate sensitive sector.

ILK is relevant for agriculture, animal husbandry and ethnic veterinary medicine, and the use and management of natural resources, but can also be important for primary health care (PHC), preventive medicine and psycho-social care, as well as saving and lending, community development, poverty alleviation and adaptation to change (climate and global changes).

Indigenous and local knowledge and practices (ILKP) are based on tacit (unspoken or implicit) knowledge, local and embedded in culture. They are experiential and constantly changing. Practices

are important to highlight the direct contributions of IPLCs to the stewardship and management of nature and NBP, and its relevance to the larger society.

Key issues in ILKP are related to:

- Property rights of indigenous knowledge.
- National policies in support of knowledge for development.
- The role of information and communication technology.
- Specific context, which is why ILKP are therefore often questioned for their validity.
- Property rights of indigenous knowledge (Free Prior Informed Consent).

The ILKP related assessment methodology usually involves:

- Multiple methods, approaches and tools;
- Socio-ecological systems approach;
- Systematic literature review to identify the key issues, gaps, challenges and opportunities;
- Key global and regional processes;
- Identifying the existing gaps in the knowledge and practices; and
- The use of synthesised knowledge by integrating ILK and modern scientific knowledge.

Dr. Karki highlighted as further principles for working on ILKP in the IPBES assessment:

- Providing opportunities for dialogue with IPLC's focusing on topics relevant to IPBES;
- Allowing time for decision-making through customary and traditional institutions to identify common goals;
- Pursuing dynamic and interactive ways for working with ILK and natural and social science communities in the Platform;
- Practicing a participatory and inclusive approach towards ILK holders; and
- Enriching the dialogue between knowledge systems as a two-way process, which includes "giving back" to ILK holders.

The recommended general approach involves co-design, co-analysis of diverse knowledge systems and co-publishing, which leads to the generation of new knowledge. However, Dr. Karki stressed that this is the thinking among the experts, and that now practical solutions for integration are needed.

The IBPES assessment should draw from the expertise on ILK of:

- ILK holders, who are people functioning within the collective knowledge systems of IPLC with knowledge from their own community.

- ILK experts and ILK professionals, who represent both indigenous peoples and local communities who have knowledge and expertise ILK and associated issues.
- Experts on ILK who have knowledge about ILK and other knowledge systems, but are, not from indigenous peoples and local communities.
- ILK TF does not cover everything, which explains the need for dialogue.

Dr. Karki's presentation was followed by Prof. Chaudhary who made presentation on:

11) Indigenous Management of Grasslands (pasturelands) in the Kailash Sacred Landscape of Nepal

Prof. Chaudhary mentioned that this topic is related to Ms. Mohamadifar's presentation on pasture management in Iran.

Kailash Mountain is considered a sacred mountain. The Kailash Sacred Landscape (KLS) is shared between four districts in Nepal. There is interdependency with cross-border areas in India and Tibet Autonomous Region (TAR, China). While indigenous communities provide NTFPs/MAPs, timber, *furu* (cup to drink tea which is highly respected), animal parts and dairy products from Nepal's KLS, *thobe* (alcohol), beer, flour, salt, sheep and goats, wool, and clothes enter the landscape from China, and salt, sugar, clothes and daily life commodities from India.

Pastoral migration is one of the important livelihood strategies of local people. People of the KSL-Nepal, especially in the northern parts, practice transhumance, moving their herds to pastures at different elevations, within their traditional territories. The Chinese border used to be open to herders, but it is now closed to them. Pastoral migration is one of the important livelihood strategies of local peoples.

All the animals are taken to summer season/ pasture, called 'Soika' after planting of crops in April/May. The pastures for rainy season called 'Yarka' are higher up. Usually, around August with the onset of 'Tonka' season (autumn) pastoralists start bringing down their animals to lower elevation pasture. Around the end of the 'Tonka' season, crops are also harvested and animals are brought back close to the village when the 'Ghunka' (winter) season begins. These rotational grazing systems are closely monitored and regulated by the community. If any individual is found grazing animals in 'Ghunka' pasture in other season, he/she is severely punished. As a traditional management practice, grasses and other plants are cut annually only once in September-October. The grasses are dried, stored and used as fodder only during winter months.

Indigenous institutions are still important for management of pasturelands in the KSL-Nepal:

- *Talukdars* or *Mukhiyas* (locally 'Gowa') are still the persons with the main responsibility of local revenue collection.
- Local people in some villages of Humla District elect the chairperson of their village development committee (VDC) every year, whereas in the national context there have been no local elections for more than a decade. There are two more types of officials called 'Loiba' and 'Lora', which are rotated annually.
- Monasteries play a vital role in conservation of wildlife (e.g. contributed to protection of snow leopard), management of resources, and regulation of socio-cultural practices including agriculture and transhumance.

Recent issues and challenges include:
(i) In 'goth' areas (livestock assembly points) there is presence of grazing resistant/tolerant species, clearly indicating some level of high grazing pressure.
(ii) Ways to integrate the traditional management practice with scientific studies.

The main finding of the study is that indigenous peoples and local communities have an understanding of the properties of biodiversity and ecosystem services, and the techniques for using and managing them sustainably. However, to addresses the existing challenges, governance of the natural resources and related policies need to be developed based on both IK and scientific results.

Dr. Karki: The Kailash Sacred Landscape is an example of transboundary and regional landscape management.

Next, Prof. Krishna K. Shrestha (President, ESON) presented on:

12) Bioprospecting of Plant Resources for Validation of Indigenous Knowledge and Search for Novel Herbal Drugs in Nepal

Medicinal plants rich in phytochemicals have been used for centuries in treatment and prevention of diseases. Several compounds and their synthetic or semi-synthetic analogues are in therapeutic use.

The aim of the study is to explore the crucial role of ethnobotany as follows:

- Focused on underutilized ethno-medicinal plants;
- Documented habitat features, photographs, herbarium of 200 plant species samples;
- Primary data collected from communities, the Indigenous Local Knowledge (ILK) holders;
- Secondary data collected from ethnobotanical literature; and

- Altogether 24 important plant species were analysed in the first phase in Nepal; and later Korea for further analysis.

Based on similar research questions, the study has undertaken resource mapping in Eastern Nepal showing where the ILK holders are, what their forest resources are, where the hotspots of MAPs are, and what other plant resources are utilised.

Bioprospecting of Nepalese plant resources conducted by Tribhuvan University and its partners investigated:

- The Cytotoxicity of Plant Extracts in Human Cervical Cancer;
- Antimicrobial activities of methanolic plant extracts (e.g. Amala (*Phyllanthus emblica*) has been used for centuries to kill bacteria responsible for skin diseases); and
- Mosquito control concerned with several vector-borne diseases based on natural products, which have less harmful effect due to their innate biodegradability.

A study on Nepalese sumac (*Rhus parviflora*) conducted by Dr. Sabina Shrestha showed that local knowledge can be validated through modern science. It leads to two patent rights in Korea: (i) nerve protection from oxidative stress, and (ii) preventing and treating neurodegenerative disease.

Future goals with respect to bioprospecting in relation with ILK are:

- Achieve the national goal for the bioprospecting of ethno-medicinal plant resources.
- Infrastructure development and capacity building (training, exchange visits).
- Regular publication of journals, reports, proceedings, focusing on ILK.
- Organisation of conferences and training workshops facilitating ILK learners and ILK experts.
- *In-situ* and *ex-situ* conservation for sustainable harvesting of medicinal plant resources.
- Develop high value added natural drugs / nutraceuticals.
- Ensure Patent Rights (PR) and honour Intellectual Property Rights (IPR), and
- Equitable sharing of benefits for community development and economic development of Nepal.

Another study might be interested to investigate the nutraceutical and medicinal values of 24 species of Himalayan raspberry (*Rubus* species), native to Nepal. *Rubus ellipticus* ('Pahenlo aaiselu') is widely consumed in the hilly regions as a delicious wild edible fruit. A local wine "Hingwa" is made from the raspberry, and is most popular in Nepal. Similarly, it has medicinal properties too. Therefore, it is worth investigating in detail the nutraceutical and pharmaceutical value.

All studies revealed a need for bioprospecting of Nepalese plant resources to:

- Address species loss due to degradation of habitat and climate change;
- Validate indigenous and local knowledge; and
- Establish ISO certified modern research laboratories for natural product research in Nepal.

The presentations were followed by a Q & A session.

Dr. Karki: Presentations will be compiled and shared as multimedia by the end of the second day. However, the results of the assessment cannot be shared externally before approval from governments is obtained.

Q: Kailash Sacred Landscape: Thinking about the future, herders are forgetting traditional practices, and many of these pastures will be without pastoral communities. Do you think anything can be done to reverse this trend?

Prof. Chaudhary: It is a very important issue that herders are losing their knowledge, and not receiving policy support. This needs to be addressed. Together with Prof. Wu Ning we will consider this issue.

Prof. Ning to Prof. Shrestha: Are there risks of overuse of the species you presented from their commercialisation?

Prof. Shrestha: We are not focusing on rare and threatened species, which cannot be easily found. We are focusing on underutilised species that are found everywhere. There is not such a risk from their use and it will be beneficial to the local communities.

Dr. Karki: When you bring out the knowledge, it is important to contribute to the creation of related institutions. There can be opportunities for commercialisation.

Prof. Tiwari: There are a number of species that have not been overused despite bioprospecting.

Q: The main issue related to pastures is ownership. One government decision on pastureland in Iran has destabilised the management of the pastures. Who owns the pastures in China and Nepal?

Prof. Chaudhary: Nationalisation of forests happened in Nepal as well in 1957. Pasture lands still belong to the Government of Nepal. Local communities in eastern Nepal also consider the land belongs to the communities/institutions. These issues need to be clarified.

Prof. Gautam: While communities are doing so well in conservation, they often live in miserable conditions. If we find that it is important to investigate these traditional conservation systems, we need to provide evidence to the policymakers. This is a major challenge.

Prof. Ning: In China the government leases pastoral lands to herders for a period of 70 years. They have use rights.

Dr. Karki: There are many good examples. Countries can decide which scenarios they want to use. We cannot be prescriptive, we can only present our recommendations as viable options.

1 December 2016

At the beginning of the second day of the workshop, Dr. Madhav Karki introduced ILK holder Dr. Gopal Dahit Tharu, Tharu Indigenous NGO Federation, who was unable to attend the first day due to commitments in national parliament.

13) Tharus Indigenous Knowledge and Medical System

Dr. Gopal Dahit Tharu delivered a presentation entitled "Tharus Indigenous Knowledge and Medical System" of the Tharus indigenous people. First he provided an introduction to the indigenous knowledge and medical systems. He explained that the local terms to call the Tharus practitioners of medicinal plants vary throughout the Tharus communities of the country, but their main power is the same. He also pointed out that the Tharus medical system has its origins in "Tharus wise medicates and/or saints as per needs and priorities based on spiritual salvation, divine grace and devotion and empirical practice of using medicinal plants" and this knowledge has been passed on from one generation to another in oral form. There are Tharus myths about "Gurbaba", who created Earth and all living beings. His story is related to the tradition of medicinal plant use, as he had broad knowledge including medical knowledge, which he passed on to his son, and then throughout generations.

Tharus indigenous knowledge comprises about 600 species of medicinal plants but the actual number might be higher if an in-depth study is carried out all over the Tharuhat region. Apart from its medicinal values, Tharus medicinal knowledge is important from various perspectives. It has ensured the preservation of the people's identity in the Tarai, the lowlands of Nepal, based on their broad knowledge of local medicinal plants. From a culture preservation and promotion perspective, Tharus also use medicinal plants during ceremonies such as birth and marriage. From a socio-economic perspective, Tharus have started selling medicinal plant products to Indian traders, which contributes to income generation. In addition, the Tharus ILKP has values from the perspective of environment protection.

However, Tharu communities are facing various serious issues. The quality, quantity and frequency of using Tharus medical system is decreasing day by day. This is because of internal and external causes. Medical practitioners have traditional authority but no legal certificates from the Government of Nepal, which has demoralised them and contributed to an increasing discontinuation of traditional practices. The 'jungle' is held by government which is a serious problem. Tharus practitioners are prevented from collecting medicinal plants from the forest.

Dr. Madhav Karki: Dr. Dahit's presentation was both emotional and educational which shows how concerned many ILK holders are regarding the vanishing of their age-old knowledge and practices.

Prof. Shrestha: We hope to contribute to further investigation on and the maintenance of the Tharus TK, by using modern technology, and ensuring Intellectual Property Right of ILK holders. Earlier a team of ESON had documented indigenous knowledge of Tharu community in Bardia and Kailali districts, especially on ethnomedicinal plants.

Mr. Lopez-Casero: Tharus people are considered to be comparatively resistant to Malaria. Is this due to traditional knowledge?

Dr. Dahit: In the Tarai areas, Tharus have lived for thousands of years. Malaria was epidemic in the area. Tharus have the practices of eating certain types of food (special kind of snails) which helped Tharus to become more immune to Malaria. They also eat local type of 'mar' (soup prepared from rice), pig meat, onion, and traditional wines, which also helped to develop a resistance against Malaria epidemic. Worships, including mantras, also helped to become more immune. However, intergenerational transfer of TK is not happening appropriately. Recording the mantras will help maintain this knowledge.

Responding to Prof. Shrestha's offer to collaborate in research and maintenance of the Tharus TK, we look forward to working together.

Dr. Shinwari: There is an idea that epidemics rise if there is loss of biodiversity. If the ecosystem is intact, epidemic diseases will decrease.

3.4 Chapter-wise writing session

Dr. Karki introduced the session of Authors presentations explaining that the IPBES regional assessment has been under preparation for over one year. Since, involvement in the assessment is voluntary, authors have provided their own time. The recommendations of the assessment need to be useful for implementation by governments and other stakeholders. The assessment needs to address the vanishing traditional knowledge and practices, and identify options for better management of ecosystem services and biodiversity. The assessment includes six chapters.

Chapter 1 - Setting the scene for biodiversity and ecosystem services in the Asia and Pacific (Presented by Dr. Madhav Karki)

The objective of the first chapter is to set the scene with regards to biodiversity and ecosystem services. The expected outcome of the chapter includes awareness-raising, interest to understand the state of regional and nature's value, national trends, drivers, scenarios and policy options. Preparation of the second order draft is under way.

Chapter expectations from the workshop include:

- **Learning**: since the objective is knowledge, sharing, learning and assimilating, we expect to hear new case studies especially on balancing conservation needs with development necessity.
- **Sharing**: we want to share what we feel are challenges and opportunities in applying ILKP in sustainable managing biodiversity and ecosystem services.
- **Documenting**: Interesting case studies and useable information and knowledge.

Each chapter is like a book. Without reading other chapters it should be possible to understand the contents of one chapter. To get the full picture you need to read all the chapters.

The assessment needs to say that the Asia Pacific region is one of the most diverse regions in the world. We also want to see different values considered, both monetary and non-monetary values. There are multiple values. The intangible values are also important.

Each chapter has two review editors, whose main role is to make sure that this will be an inclusive and integrated assessment. Indigenous knowledge has to have indigenous institutions. If institutions survive, knowledge will survive. This needs to be considered. The authors need to consider published literature to identify their key messages, and we need more case studies.

Chapter 2 – Nature's benefits to people and quality of life (Presented by Prof. Ambika Gautam)

The Chapter reflects the IPBES Conceptual Framework boxes "Nature's benefits to people" and "Good quality of life", and the fluxes between them.

There is a need for understanding the ILK in a systematic and integrated way. Authors need to consider how it relates to all the other chapters, including for the methodology.

A key challenge is how to equitably and meaningfully present ILK across such a diverse AP region. The three main approaches to address this challenge are: (i) identification of key themes of

significance to ILK holders across the region that can assist in equitable and meaningful representation; (ii) collection/compilation of case studies; and (iii) selection and use of ILK indicators.

Possible key and additional themes of the chapter include:

- Colonialism, including post-colonialism and neo-colonialism, as a driver of change to nature's benefits to people (NBP) and good quality of life (GQL).
- Differential impacts of nuclear cycle on indigenous peoples.
- Seasonal and traditional calendars as critical representations of interlinkages between nature, people and GQL.
- Community-based monitoring and cultural indicators used by IPLC for management of biodiversity and ecosystem services (BES).
- Customary laws about taboos as effective for management of BES in the Asia-Pacific.
- Crafts (e.g. weaving, boat-making, etc.) as critical interconnections that ensure management of BES.
- Adjustment of environmental laws to take account of diversity of cultures and cultural institutions that mediate people-environment relationships in the diverse region.
- Traditional irrigation systems based on ILK as contributors to water security (case studies China, Qanat system in Iran, Badghariya system in Nepal).
- Sustainable harvesting as a driver of conservation (medicinal plants - Laos, stranded whales and eels - NZ, bird feathers - PNG, honey - India)
- Customary rituals to support cultural and natural conservation (Philippines).
- Diversified farming systems based on ILK as contributors to agrobiodiversity (case studies from Laos, and China).

Chapter expectations from the workshop include:

- Enhancement of authors' knowledge on ILK issues.
- Comments/suggestions on the approaches proposed.
- Contributions of the workshop participants in the form of case studies and literature.
- Other suggestions to better incorporate ILK in the Chapter.

The presentation was followed by a brief discussion.

Mr. Neshat: It was very good to understand about the quality of life. However, you talked less about institutions. Institutions are very important, as I believe they have been ignored so far.

Dr. Karki: We have a data gap on West Asia in terms of both knowledge and knowledge systems. Regarding local water management systems, it is important to identify the change drivers including towards modern science based engineering system. Please provide clear literature.

Prof. Gautam: The Qanat system you mentioned yesterday is already on the radar. How changes in the indigenous knowledge system has affected this irrigation are very important for us.

Shinwari: In Pakistan, the Kari system is an underground water management to prevent water from evaporation. We could include this system.

Dr. Karki: It would be good if your literature could provide national level policies and any changes in practices. It is important to identify what led to the recognition of local management systems.

Prof. Gautam: We see also water management systems as providing quality of life. Any knowledge I gain through this regional assessment will also be useful for the global assessment where I am involved in policy assessment.

Dr. Karki: Each chapter will provide a full list of the authors and full list of citations. In chapter 1 we will provide the structure of the whole regional assessment, and show how the reader can navigate through the different chapters.

Regarding the second chapter, it is related to the whole values system. How have you planned to consider different dimensions and levels?

Prof. Gautam: The Asia-Pacific will be the key level, but we will talk about the sub-regional level as well, and show local cases in boxes.

Dr. Karki: The draft is not yet ready, because it is a working draft. We shared it in this closed meeting. We received 2,700 comments on the draft chapters that were published and are addressing these now. Today we can share the key messages from chapters.

Chapter 3 – Status, trends and future dynamics of biodiversity and ecosystems underpinning nature's benefits to people (Presented by Prof. Gopal S. Rawat)

The objective of this chapter is to assess the status, trends and future dynamics of biodiversity and ecosystems underpinning nature's benefits to people.

Expected outcomes include to better educate the scientific community, conservation agencies and policy makers about the status and trends in biodiversity and ecosystem services, and that biodiversity and ecosystem services are mainstreamed into development planning.

Major ILK-related gaps include:

- What have been the contributions of ILKPs to reach Aichi targets 11, 12, 13 and 14 in the APR?
- How have the drivers affected IPLCs undermined/constrained the attainment of the achievement goals of Aichi target 14 in APR?

It is also still challenging to get more and better case studies, because it is difficult to find related literature. So far we have reviewed some literature from Australia and Pacific islands ecosystems. One key finding is that there has been some 30% decline of ILK there.

We are trying to address questions related to ILK and linkages with Aichi Targets. We would like to interpret the findings made in Chapters 2 and 4. The second order draft is to be submitted by mid December. There is regional imbalance between South and West Asia on ILKPs.

Expectations from the workshop include:

- Case studies form South and West Asia on ILKPs.
- Robust empirical evidences from case studies.
- Peer reviewed publications on good practices, evidences, artefacts, anecdotes and success stories.

We will also consider community forestry and other forestry systems, traditional health care systems, traditional fishing, etc. We will look at which systems are conservation friendly and which ones are not. Hundreds of languages have vanished, but there is a lack of literature on this. We want to strengthen this review. Excessive hunting is not conservation friendly, so ways to promote sustainable hunting need to be addressed.

The presentation was followed by a brief discussion.

Mr. Pudasaini: How are you going to consider future trends?

Prof. Rawat: The declining trend of forest cover has been revised in some countries. We are also planning to show such positive examples. In some countries, local communities and governments have started to pay attention to aquatic ecosystems. For species that are on the brink of extinction, we will discuss how this will develop, if it is not addressed by policies.

Q: We are moving from ILK and ILKP. Can we do this in Chapter 3?

Prof. Tiwari: I can provide a case study on this. How much space will be allocated to linguistics, which is not directly linked to our main work? Has some analysis been done for NE India?

Prof. Rawat: We would welcome to include a case study on linguistics from NE India.

Dr. Karki: This chapter is only about trends, Chapter 2 addresses the linguistics. Trends of deforestation need to be covered by Chapter 3, but the cause of land use changes will be addressed in Chapter 4. It is important to find cases where ILK and institutions have provided alternatives.

Prof. Gautam: Colleagues have tried to link maps of ILK and local languages.

Chapter 4 – Direct and indirect drivers of change in the context of different perspectives on quality of life (Presented by Prof. Wu Ning)

The objective of the Chapter 4 is to document evidence on the status and trends of drivers of change relating to biodiversity and the provision of ecosystem services in the AP region.

In this chapter we are distinguishing two types of drivers: direct and indirect drivers.

It is difficult to identify the drivers, and it is difficult to identify the borders between the drivers.

The focus is on forests, agriculture, and urban ecosystems.

All of the drivers have regional relevance. A war like in Afghanistan can also be a driver, but this has no place under this structure. We also do not have enough evidence, or any publications, on the impacts of war.

We consider the trends in the achievement of Aichi targets.

The first order draft has been completed, and a second order draft is being developed.

We need to consider that in new situations, TK may not be suitable to be used.

We consider the Satoyama Initiative.

There are three types of gaps and needs on ILK:

- **Knowledge areas**: Forestry (community forest), NTFPs collection, Agriculture (shifting cultivation), Pastoralism (Transhumance, native breeds, etc.), fishery (spear using), or any knowledge/practices related to conservation of biodiversity.
- **Information and Data gaps**: ILK holders/experts are expected to provide detailed evidence, data, or written records what would constitute a "good" case study so that ILK could be effectively incorporated into Chapter 4.
- **Practice, evidence, artefacts, anecdotes, and success stories**: A few boxes could be used to illustrate these "Stories".

In terms of chapter expectations from the workshop, it would be good to have more 'good' stories, evidence or records from ILK experts, as well as to learn from experiences of other chapter on how to integrate 'good' cases into the overall context.

It would be good to see if traditionally-managed community forests are more able to conserve biodiversity than those not managed traditionally.

The presentation was followed by a brief discussion.

Dr. Karki: Drivers are very important. They are also related to Chapter 2, as the behaviour is also interlinked with the value system. This chapter is very important for the whole assessment.

Prof. Rawat: We should consider collection practices of caterpillar mushroom. To what extent should this be considered as traditional practices or recent practices? And which chapter should address this?

Prof. Ning: This is a challenge that also applies to medicinal plants, as some face overexploitation of resources. Therefore, one of the biggest drivers is economic.

Dr. Karki: I believe local people have been traditionally using caterpillar mushroom, but this has been taken over by the emergence of economic value. While governments want to ban, the trade goes underground and exploitation increases. If it is made a legal product managed under the regime of sustainable harvesting and use, both the economic well-being of local people and biodiversity of mushroom can be perhaps protected. We need to put the use of caterpillar mushroom in this traditional context. We need to see whether their value system has changed.

Mr. Davidson Saragunam Selvanayagam: It is important to secure employment opportunities in the government sector. In India, schedule tribes are given priority in the employment. This enhances

better socio-economic status. The value system is changing. With the latest changes, people go to school until the age of 18. But there are a lot of problems such as child marriage.

Dr. Karki: We need to consider multiple and changing value systems.

Prof. Chaudhary: We could put mountains in a separate box of the chapter. How have mountain issues been treated in other chapters?

Prof. Rawat: In Chapter 3, we have mountain ecosystems separately.

Dr. Karki: It is ecosystems rather than geography that we consider. We now have a classification in Chapter 1 that we all have to use. In the IPBES conceptual framework we have a separation of direct and indirect drivers. Under direct drivers we have no distinction between natural and anthropogenic drivers.

Prof. Tiwari: Not all freshwater ecosystems can be considered as wetlands. There are streams within the forest, or seasonal streams. How can this be considered? We also need to consider riverside mining as an important driver.

Prof. Ning: We have discussed these issues. We use a narrow definition of wetlands. In Chapter 3 lakes and ponds, rivers and streams, and swamps are considered separately.

Dr. Karki: River mining and biodiversity loss overlap. We need to consider this somewhere.

Prof. Ning: If you can provide a good publication on riverside mining can you please provide it.

Prof. Chaudhary: Can you provide examples of how to present case studies as “good stories”?

Dr. Karki: There are definitions of good case studies in the literature. The story needs to start with the genesis of the problem, to the solution, including time series data. We need case studies on how ILK works, what the values and practices are, and consider solutions provided by participants.

Prof. Ning: It is important how traditional medicine and ILK are related, rather than what the traditional medicines are.

Prof. Gautam: We are using an ecosystem based approach, sub-regional type of analysis. How can we select information to represent the whole subregion?

Dr. Karki: For ILK experts, the message is ‘We have gaps in terms of the coverage of different knowledge systems in the assessment’. The new thing in the assessment is that we provide options that are practical and can be implemented by the constituency, which is related to nature. The need

of the constituency should be addressed in the chapters, and this is related to the sustainability framework.

Prof. Shrestha: It would be useful to see other chapters' drafts.

Dr. Karki: We will seek volunteers, who are willing to share their draft first.

Chapter 5 - Integrated and cross-scale analysis of interactions of the natural world and human society

The presentation on Chapter 5 was delivered by Dr. Madhav Karki on behalf of Dr. Haripriya Gundimeda, CLA, Chapter 5 who could not participate.

The objective of the chapter is to address the interactions between changes in indirect drivers, direct drivers, biodiversity and ecosystem services and consequences thereof to the benefits derived by people from nature. The chapter relies on the use of scenarios and modelling based approaches to predict the most plausible scenarios for biodiversity and ecosystem services for the Asia and Pacific in future. The scenarios will be framed in the IPBES conceptual framework and focuses on examining the interaction between human and nature now and in the future.

It is important to review different assessments like the Global Biodiversity Outlook 4, IPCC fourth assessment report, the millennium ecosystem assessments, and TEEB. Climate change is mentioned as one of the stress factors. The Chapter is going to use explorative scenarios and storytelling for the short, medium, and long term. There is considerable interaction with Chapter 3 and considering nature's benefits to people.

ILK is operating at a micro-scale, which means that it is often ignored. The question is how ILK and ILK practitioners can become more visible while modelling and projecting the plausible relation between humans and nature in the AP. The scenario and model assessment will be regional, but recommendations will be presented at the sub-regional level, not at the national level. We only provide options at the sub-regional level with plausible scenarios and models. They have challenges regarding how to address and link the levels.

An important question is how to address diversity within ILK holders. The scenarios should reflect the reality. The Chapter authors want to show that shifting cultivation is changing, rather than

judging it. Participatory scenario planning will be useful for Chapter 6. Participatory governance is becoming more mainstream.

Models are useful, as there are existing models and they provide options for policymakers.

Chapter 6 - Options for governance, institutional arrangements and private and public decision-making across scales and sectors (Presented by Prof. Shyam Sharma)

The objective of the chapter is to analyse and present governance and institutional settings across different scales and sectors and to provide policy options and mixes for decision-makers of both public and private sectors for mainstreaming conservation of biodiversity and ecosystem services at all levels in the Asia-Pacific region.

The expected outcome is detailed analysis of existing governance systems and possible policy options/mixes for policy and decision-makers for mainstreaming conservation of BES across different scales and sectors in the Asia-Pacific Region.

Prof. Sharma emphasised that scientific validation of ILK is key and helps all stakeholders. He illustrated this using the case study of Red Rice Cultivation in Himachal Pradesh, India as an example. Red rice varieties had been nearly abandoned by farmers in Himachal Pradesh. However, the ILK about the red rice varieties has been validated scientifically and now these are commanding higher prices. This case study shows that scientific validation can lead to higher income and also biodiversity conservation.

The presentation was followed by a brief discussion.

Dr. Karki: In Chapter 5 there are number of examples of participatory scenario building and governance systems, including ILK and ILKP based management systems, which allow for better provision of nature's benefits to people.

In Chapter 4 we will we see the impacts of socio-economic and institutional drivers.

We heard about positive cases, such as community-based management in Kerala, where there is a fair benefit sharing and livelihoods of communities have improved. How are you addressing this in your chapter?

Prof. Sharma: We will recommend that the governments need to have a policy on ILK.

Dr. Ganesh Raj Joshi: We have looked into the institutional context for the framework.

Dr. Karki: Chapter 6 needs to use all the information provided by others.

Prof. Chaudhary: There are countries where community-based management has played a very important role. How will this be addressed? Apart from national legislation, there are bilateral agreements that are very important. Are you considering these also?

Prof. Shinwari: There is a strong need to educate our parliamentarians. A leopard attacked school children. Research knowledge showed that leopards attack easy prey, when wild prey is not available. When the media made a complaint about this, the researcher withdrew his statement.

Dr. Karki: Talking about the regional level, the assessment distinguishes 5 subregions in Asia. In the Asia-Pacific we have some management systems which are more based on ecosystem boundaries, rather than political boundaries (e.g. Kailash Sacred Landscape).

Prof. Ning: In Chapter 4, this issue is very important. We hope authors from chapter 6 can improve this. The governance has changed in the subregion. Earlier we had conventional governance systems. We need to discuss if we can learn from the traditional governance systems. If the governance system changes, scenarios should also change.

Prof. Rawat: The Aichi Target 11 on Protected Areas has been achieved. What is lacking is biodiversity conservation planning. In some countries this needs to be conducted. One point for consideration is if there is any analysis of National Biodiversity Strategy and Action Plans?

Dr. Karki: In Iran the government is giving herders management rights of pasturelands again. Boxes can be provided on such areas.

Prof. Ning: Policies are very important, including on pastoralism. Demographic studies also need to be considered, for example on migration. In the AP region, the forest area has increased overall, but there have been more contributions from China and Thailand than from other countries.

Dr. Joshi: When forest management was handed over to communities in Nepal gradually starting from 1993, forest cover also started to increase. In the mid-hills it is now around 42%, but in the Tarai lowland forest cover did not increase. There is now collaborative forest management, but there are some mismanagement issues. That is why the policy aspect is very important.

Prof. Tiwari: We are talking about policies at different levels, but not about local policies. Local level governance should also be addressed, as for local policies ILK may be particularly important.

In NE there is an ongoing process of documenting biodiversity including knowledge. The community conserved areas receive strength from wildlife conservation.

Prof. Gautam: Policies are one of the important drivers, but the context also has an important role to play. Policies has also temporal dimensions. A policy that is successful at one time, may not be useful 20 years later.

Mr. Neshat: Interaction is the most important aspect of policymaking.

Prof. Sharma: There is a need for some legislation to document, recognise, validate and promote ILK. The related institutions also need to be recognised.

Three groups were formed (one for Chapters 1 and 2, 3 and 4, and 6 respectively, as Chapter five was not represented). The purpose of the group work was to identify ways of including ILK and related cases can be included in the assessment report.

After the group work, the CLAs of each chapter presented back to the Plenary.

Chapter 1-2 (7 people – 1 Iran, 6 Nepal)

Five presenters participated in the group.

Dr. Karki (for Chapter 1): Scientific investigation which uses ILK as a basis takes less time and money. The rate of discovery of useful components and chemical constituents of plants is much higher. The diverse use of different types of fibres provides opportunities. The work done in Kailash Sacred Landscape is another success story that will be highlighted in the chapter.

Prof. Gautam (for Chapter 2): We discussed multiple benefits of nature to people. Most of the cases have not been published. Although they are interesting, reviewed journal articles will have preference. However, we may be able to include the findings as expert science. How can science help validate and value add ILK? We will look at some literature to include it in the report. ILK holders and experts may be contacted by CLA.

Chapter 3 & 4

Prof. Rawat (for Chapter 3): Three thematic areas were discussed:

(1) Sustainable harvesting of NTFPs, including medicinal plants, and how this contributes to the validation of traditional knowledge systems, and beliefs. Some belief systems need to be respected although they cannot be validated.

(2) Traditional fisheries practices in marine areas, and how intimate knowledge from local fishermen about seabeds and species can be used.

(3) Shifting cultivation and how it can enter into conflict with national policies and affect biodiversity.

There will be resources available to discuss cases in both India and China, taking into considering cases from SE Asia.

Prof. Ning (for Chapter 4): The group discussion not only considered negative, but also positive impacts of driver. This is also true for urbanisation. We discussed shifting cultivation, which is generally in decline. We suggest different policies to deal with shifting cultivation.

Dr. Karki: Chapter 5 will focus on scenarios.

Chapter 6 (representatives from Pakistan, Iran, and Nepal)

Points to be taken into consideration include with respect to ILK related policies:

- Participatory rights (CBNR).
- Public-private-community based approaches better than public approach alone.
- Strengthening of institutions.
- Capacity building on mass communication.
- Autonomy within the legal framework.
- Gender and social inclusion.
- Importance of motivation and mobilisation for ILK related policies.
- Resources, responsibilities, and returns.
- Social culture.
- Policies regarding ILK should be flexible, both in terms of spatial and temporal implementation.
- Externalities (market force, technologies, political).
- Integration of science, including identification of synergies (National -> Local scales).

Dr. Karki: If the papers can be included in the proceedings, then the authors are authorised to use these proceedings like peer review journal articles.

3.5 Presentation on ILK network: Concept of establishment of ILK network for South and West Asia Sub-region

Prof. Shrestha: The organisations in Nepal involved in the Workshop Organisation Committee have already established collaboration and would be eligible for networking.

Dr. Karki: A network is active if networkers are active. We need people who are experienced, dedicated and can drive the network. The network is largely web-based with some limited opportunity of physical meetings.

Prof. Rawat: This is a useful suggestion. The Wildlife Institute of India based in Dehradun would be in a good position to contribute.

Mr. Robert Panipilla: There should also be a scope to include organisations working on marine ecosystems.

Mr. Pudasaini: We need to have considerations to have the network function: A short time, low cost approach could be useful.

Dr. Joshi: How to make the network work is important. It should be voluntary and cost-effective.

Prof. Gautam: The minimum requirement for the network would be one person who communicates and motivates. It is important to have a secretariat or manager, who has relevant ILK holders information.

Prof. Tiwari: I have volunteered to join and contribute. I can only be a member and share information.

Prof. Chaudhary: Sustainability is important. There should be an institutional set up. Regarding criteria, we need all ecosystems and all kind of stakeholders to be represented (government, communities, private sector, etc.).

Dr. Karki: It would be appreciated if the network is established as an outcome of this sub-regional dialogue workshop. The network should be functional and have a long life. It should be cost-effective. It should have a node and node manager, from where the information flows. There is interest and ownership from the participants to contribute to the network. IPBES has strong commitment to ILK, and the Taskforce is already in the raster. Whoever wants to consult ILK or ILK holders, should be able contact the reference group.

Mr. Sakurai thanked the participants for their input and announced that the JBF Team will consider how to establish the network.

3.6 Closing Session

Dr. Karki: To start the closing session, we should recognise important representatives.

Panel of the Closing Session included:

- As the Chief Guest, the Honourable Commissioner of the Commission of Abuse of Authority, Nepal, Dr. Ganesh Raj Joshi
- As the Chair, Prof. Dr. Chintamani Pokharel, Dean, Faculty of Humanity and Social Sciences
- Mr. Durga Prasad Pandey, Executive Director, ReCAST: Prof. Dr. Ram Prasad Chaudhary
- Dr. Madhav Karki, Member of the ILK Task Force and Asia Pacific Dialogue Workshop plus the Co-chair, IPBES Asia Pacific regional Assessment of Biodiversity and Ecosystem Services.

On behalf of ILK holders and experts Mr. Shinwari thanked the organisation committee and all participants.

Mr. Sakurai expressed his hope that this meeting was a good opportunity to strengthen the relationship among participants and that this relationship can be developed further.

Dr. Karki: There are 18 participants who responded to the call by the JBF team. The purpose of the workshop was to bring together the ILK experts and holders and the authors of the assessment together, to co-produce knowledge. If we include inclusive knowledge, we will have an inclusive report. This kind of dialogue has already happened in the other subregions. We hope this will enrich the assessment report that we are preparing. We could identify the opportunities to integrate ILK in policymaking as well as any gaps. The authors can use these presentations and discussion as very useful references. It was a very successful 2-day workshop.

Prof. Chaudhary: This was a good opportunity for ReCAST, TU to contribute. He thanked Dr. Madhav Karki the JBF team from IGES, the executive director of ReCAST and all ReCAST staff.

Mr. Pandey: Referred to the meeting with local organisations of Kavre District, and to the presentations from Pakistan, Iran, India and Nepal. He thanked all participants for their contribution.

Mr. Pudasaini: On behalf of Ministry of Population and Environment, Mr. Pudasaini expressed his gratitude for the opportunity to participate and for the excellent organisation. It is important to internalise the importance of ILK for biodiversity conservation and sustainable use of ecosystems. The involvement of indigenous peoples will be a valuable asset in this regard. As the IPBES focal

point, he expressed firm belief that MoPE can play a role in contributing to the ILK network in the region. This is not the end but the beginning of this programme. He also believed that collaboration can be enhanced.

Dr. Joshi: Information on ILK provided by ILK holders and experts will be very useful to incorporate in different chapters. Intervention through markets have led to loss of ILKP in many cases, but there are also positive cases such as the red rice. Something will be reflected in each chapter, on how to promote ILKP. The workshop has also contributed to Nepal through promotion of tourism sector which suffered due to the earthquake. He encouraged participants to make the network very vibrant and functional. Dr. Joshi thanked all participants for their contribution from their own and institutional perspectives.

Prof. Pokharel: He thanked participants for their contributions. He highlighted that indigenous and local communities have played an important role in the conservation of biodiversity in Nepal. He declared the closing of the session.

4. Proposal of a sub-regional ILK network for IPBES in South and West Asia

In this section, a proposal is set out on the establishment of a sub-regional level ILK network for IPBES assessments, including the background, preliminary proposal, outline and major result of questionnaire, and outline of the discussion at the sub-regional workshop.

4.1 Background

Since the IPBES regional assessments address not only biodiversity and ecosystems, but also ecosystem services and the relationship between nature and human societies, it is expected that reference will be made to relevant ILK in order to carry out a comprehensive assessment. The importance of incorporating ILK is stipulated as one of the key principles of IPBES; “Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems (UNEP/IPBES.MI/2/9 II2 (d)).

However, ILK-related information is often not well documented and so it may not always be available. In order to effectively identify and bring available ILK into the APRA, the JBF project has recognised the importance of networks or regional hubs to facilitate and support bridging ILK holders/experts and IPBES authors in their project.

Therefore, the project envisages that sub-regional level ILK networks, hubs or any form of frameworks will be established to facilitate identifying key ILK holders, experts, information and documentation on ILK, and communication between ILK communities and academia.

At the regional ILK Dialogue Workshop for Asia-Pacific, which was organised by UNESCO as ILK-TSU, in June 2016 in Chiang Mai, Thailand, many ILK cases were presented and shared with some IPBES authors of the IPBES Asia-Pacific Regional Assessment. The JBF Project team members also participated and had a consultation session with the participants about the idea of establishing sub-regional hubs or networks for ILK. Through the fruitful discussion on this issue, the JBF project recognised the strong need for such networking by receiving positive and encouraging comments and suggestions. However, there were also many gaps identified. To fill such gaps, the project has decided to continue such consultation during the series of sub-regional dialogue workshops planned under to follow up the regional workshop held in June 2016. A questionnaire survey was also conducted to collect necessary information to identify further needs and gaps on this matter.

4.2 Preliminary proposal of IGES for the sub-regional networking and facilitation related to ILK

IGES considers that the establishment of sub-regional ILK Network is needed, because it is expected to greatly contribute to the assessment process through facilitating communication between ILK holders/experts with IPBES authors for better understanding of ILK and also for meaningful recognition of ILK in the assessment reports in a continuous and sustainable manner. It should also recognised that it is important to carry out networking of ILK holders, networks and communities in terms of identifying and facilitating knowledge in proper ways to contribute to scientific assessment, especially to IPBES. Already several networks have been established for/by ILK stakeholders, but IGES recognised the gap in networking which focuses on knowledge and its facilitation for policy-relevant scientific assessment. One of the objectives of the project is to explore and possibly establish hubs or networks to improve the capacity of stakeholders and experts in this region. The summary of preliminary proposal prepared by IGES is described in Annex 3-1 including draft criteria for the participating organisations to the network, examples of activities of the network, and steps to establish networks.

4.3 Outline and major results of the questionnaire survey

The JBF project prepared a questionnaire to ask applicants of the sub-regional ILK Dialogue workshops about information on the needs, challenges, or gaps for effective and meaningful facilitation of ILK and communication among ILK holders, indigenous and local communities, ILK experts, and regional assessment authors. The results of the survey have been compiled and shared by the sub-regional workshop participants. The results of the survey in the South and West Asia sub-region are described in the following sections.

4.3.1 Target countries, activities and issues, and major languages

The project received nine (9) replies to the questionnaires. Among them, eight (8) organisations and one (1) project team expressed an interest in participating in the network.

The target countries of the organisations are India (3 organisations), Nepal (4), Bhutan (1), China (1), Iran (1), and Pakistan (1).(See Annex 3-2, Table 3-2-1.)

Many organisations conduct activities and issues on research & documentation (5 organisations), capacity building (3), and conservation activities (3). The major languages of the organisations are English (9), Hindi (3), Nepali (3), Arabic (1), Persian (1), Kaani dialect (1), Tamil Malayalam (1), Tharu (1), and Urdu (1).(See Annex 3-2, Table 3-2-2.)

4.3.2 Views on the needs, challenges, concerns and suggestions for possible functions of the Sub-regional Network

A summary of results of the questionnaires detailing views on the needs, challenges, concerns and suggestions for possible functions of the sub-regional network is explained below.

Detailed responses are shown in Annex 3-2, Table 3-2-3, 3-2-4 and 3-2-5.

(1) Needs for possible functions of the sub-regional network

Responses on views about the needs were analysed from six aspects. These are institutional/policy level (9 organisations), collaboration/sharing (8), research/documentation (7), awareness/recognitions (3), capacity building and training (2), and others (4).

(2) Challenges, concerns and suggestions for possible functions of the sub-regional network

There were various responses on the challenges, concerns and suggestions of the questionnaire. The major factors of challenges and concerns were awareness and decreasing knowledge (5 organisations) as well as financial (3).

4.3.3 Contributions from organisations to the network

There were various responses on the contribution from the organisations. The major response was concerned with facilitation and coordination (9). Other contributions were presented on monitoring and evaluation, carrying research work, documentation and dissemination of information of the ILK.

There was one suggestion from an organisation to provide office space, IT support, faculty time, and graduate students to do research, documentation and application to play the role of hub for networks in South and West Asia.

Detailed responses are indicated in Annex 3-2, Table 3-2-6and3-2-7.

4.3.4 Ideas and suggestions to secure the sustainability of the network, and challenges or constraints for that

The main responses were on both ideas and suggestions to secure the sustainability of the network, and the challenges or constraints for that are explained below.

Detail response are shown in Annex 3-2, Table 3-2-8, 3-2-9 and 3-2-10.

(1) Ideas and Suggestions

There were five aspects to ideas and suggestions to secure the sustainability. These are coordination and collaboration (8 organisations), institutional support and facilities (5), research and documentation (5), membership (4), and training (4). There is one suggestion from an organisation to provide a small secretariat with network coordinator, management system, faculty of the organisation and staff to play the role of hub and networks in South and West Asia.

(2) Challenges and constraints for sustainability

There were various responses on challenges and constraints. There were three (3) responses related to documentation and language aspect, and two (2) responses related to the financial aspect.

4.4 Outline of the discussion at the South and West Asia sub-regional workshop

The Project compiled all the information provided by the participants and present it to the participants during the sub-regional workshop. Following the presentation, participants had discussions on the proposal. The following is a summary of discussions:

- The concept and idea of the ILK network seemed to be welcomed and recognised by the participants.
- The necessity of the establishment of sub-regional ILK Network was generally supported but some concerns were also raised.
- Most of the participants would like to have a vibrant and functional system with less demand on human and financial resources.

Some suggestions mentioned by the participants at the sub-regional workshop are set out below:

(1) It is necessary to consider and identify the functions of the network.

(2) It should be voluntary and cost-effective avoiding excessive demand for time and financial resources.

(3) The minimum requirement for participating organisations would be to have a focal point for communication and motivated members to contribute to the network.

(4) It is important to have a secretariat (or any kind of body) to support the activities of the network.

(5) The network should be functional. Sustainability is also important point to consider the institutional arrangements.

Detailed records of discussions are presented in Chapter 3 “Presentation on ILK network: Concept of establishment of ILK network for South and West Asia Sub-region”.

4.5 Proposal of a sub-regional ILK network for IPBES in South and West Asia

Based on the results of the questionnaire and discussions at the sub-regional workshop, the idea to establish a ILK network in the sub-region was generally agreed. Participants shared the view that the sustainability of the network is critical and the network should be reasonably functional, yet practical and realistic in terms of human, institutional land financial resources requirements.

In the questionnaire, nine (9) responses indicated agreement to participate a sub-regional network. During the discussion at the workshop, several participants showed their interests to contribute for the network.

Furthermore, regarding the supporting structure of the network or hubs, there was a positive response expressed by one participating organisation, but it was not discussed or agreed at the workshop and further discussion will be needed.

For further development of the idea of the network in the sub-region, the following issues have been identified;

- Membership criteria and membership approval procedure of the network
- Activities of the network
- Steps how to expand the network

In order to consider and develop these points, one possible idea would be to establish a decision-making body such as a Steering Committee or Coordination Committee (tentative name), or a new body based on the Organisation Committee of South and West Asia sub-regional workshop that would continue consultation and discussions, and follow up with the JBF team towards the establishment of a network and/or hub(s).

Annex 1: Participants list

1. ILK holder/expert Participants:

1. **Gopal Dahit. Ph.D.**
   Tharu Indigenous NGO Federation
   Bardia, Nepal
   Email: gopaldahit.nepal@gmail.com; dahitgopal@yahoo.com

2. **Mr. Bijay Raj Subedee**
   Ph.D. Researcher, Research Centre for Applied Science and Technology (ReCAST),
   Tribhuvan University, Nepal
   Email: gurusubedi@gmail.com

3. **Mr. Shiva Devkota**
   Ph.D. Researcher, Swiss Federal Research Institute WSL, Switzerland

   At Present, Pokhara, Kaski, Nepal
   Email: shiva.devkota@gmail.com

4. **Prof. Brajesh K. Tiwari**
   Department of Environmental Studies
   North-Eastern Hill University, Shillong, India
   Email: bktiwarinehu@gmail.com

5. **Mr. Robert Panipilla**
   Friends of Marine Life (FML)
   Kerala, India
   Email: jjohns79@gmail.com; robert_potsplants@yahoo.com

6. **Mr. Davidson Sargunam Selvanayagam**
   Tribal Foundation, Tamil Nadu, India
   Email: ssdavidson9@gmail.com

7. **Muhammad Ibrar Shinwari, Ph. D.**
   Environmental Science (Faculty of Basic and Applied Sciences)
   International Islamic University, Islamabad, Pakistan
   Email: drmishinwari@yahoo.com

8. **Saima Hashim, Ph.D.**
   Department of Weed Science
   University of Agriculture, Peshawar, Pakistan
   Email: saimahashim@yahoo.com

9. **Ms. Bahar Mohamadifar**
   Documentation and Revitalization of Indigenous Knowledge of Nomads
   Iran (Islamic Republic of)
   Email: physic_1982@yahoo.com

10. **Mr. Saeid Nouri Neshat**
    Boompajuhan Society
    Iran (Islamic Republic of)
    Email: nourineshat@gmail.com

2. Author Participants:

11. **Madhav Karki, Ph.D.**
    CGED-Nepal, Kathmandu, Nepal
    Email: karki.madhav@gmail.com

12. **Prof. Ambika P Gautam, Ph.D.**
Kathmandu Forestry College (KAFCOL), Nepal
Email: gautam.ambika@gmail.com

13. **Prof. Wu Ning, Ph.D.**
International Centre for Integrated Mountain Development (ICIMOD)
Lalitpur (Kathmandu), Nepal
Email: wu.ning@icimod.org

14. **Ganesh Raj Joshi, Ph.D.**
Commission for the Investigation of Abuse of Authority (CIAA)
Kathmandu, Nepal
Email: grjoshi20@yahoo.com

15. **Prof. Shyam Sharma, Ph.D.**
CSIR- Institute of Himalayan Bioresource Technology
Palampur, India
Email: skspbg@yahoo.co.in

16. **Prof. Gopal S. Rawat, Ph.D.**
Faculty of Wildlife Sciences, Wildlife Institute of India
Dehradun, India
Email: rawatg@wii.gov.in

3. TF member + Resource person Participants:

17. **Prof. Ram Prasad Chaudhary, Ph.D.**
Emeritus Professor, ReCAST, Tribhuvan University
Kathmandu, Nepal
Email: ram@cdbtu.wlink.com.np; ram.chaudhary53@gmail.com

18. **Prof. Krishna Kumar Shrestha, Ph.D.**
Ethnobotanical Society Nepal (ESON)
Kathmandu, Nepal
Email: kk.shrestha@eson.org.np; kkshrestha123@gmail.com

19. **Mr. Rajubabu Pudasaini**
Ministry of Population and Environment, Nepal
Email: pudasainirb@gmail.com

20. **Mr. Durga Prasad Pandey**
Research Centre for Applied Science and Technology (ReCAST),
Tribhuvan University, Katmandu, Nepal
Email: durgapandey.tu@gmail.com

4. Secretariat: IGES:

21. **Mr. Yoichi Sakurai**
JBF-IPBES Project, IGES Tokyo Office, Japan
Email: sakurai@iges.or.jp

22. **Mr. Wataru Suzuki**
IPBES-TSU-AP, Japan
Email: w-suzuki@iges.or.jp

23. **Mr. Federico Lopez-Casero**
IGES, Japan
Email: lopezcasero@iges.or.jp

24. **Ms. Sana Okayasu**
IPBES-TSU-AP, Japan
Email: okayasu@iges.or.jp

25. **Ms. Tomoshi ICHIKAWA**
JBF-IPBES Project, IGES Tokyo Office, Japan
Email: tomoshi.ichikawa@mx.iges.or.jp

5. ReCAST, Tribhuvan University, Kirtipur:

26. **Mr. Chandra Kanta Subedi**
Research Centre for Applied Science and Technology (ReCAST),
Tribhuvan University, Kathmandu, Nepal
Email: chandraks2000@yahoo.com

27. **Mr. Manoj Kumar Mishra**
Research Centre for Applied Science and Technology (ReCAST),
Tribhuvan University, Kathmandu, Nepal
Email: Mishra273@gmail.com

28. **Mr. Nanda Lal Maharjan**
Research Centre for Applied Science and Technology (ReCAST),
Tribhuvan University, Kathmandu, Nepal
Email: chandraks2000@yahoo.com

Annex 2: PPT slides on cases presented (30 Nov. and 1 Dec.)

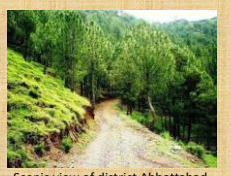
INVASIVE WEEDY SPECIES OF ABBOTABAD DISTRICT THREAT TO OUR ENVIRONMENT

SOLUTIONS THROUGH USE OF INDINENOUS KNOWLEDGE OF LOCAL COMMUNITIES

Saima Hashim
Associate Professor
The University of Agriculture Peshawar
Pakistan

Contents

- Background and Importance
- Methodology
- Outcome and findings
- Conclusion



Scenic view of district Abbottabad

"I am pessimistic about the human race because it is too ingenious for its own good. Our approach to nature is to beat it into submission.

We would stand a better chance of survival if we accommodated ourselves to this planet and viewed it appreciatively, instead of skeptically and dictatorially."

E.B. White
(1899-1985)

Study Background

- Natural environments with native plants is a result of ecological succession evolved over a period of thousand of years.
- Present day weeds, a direct consequence of technological advancement did not exist in the wilderness some years back.
- Urbanization, extensive trade, migration, reclamation and settlement of new lands, growing of useful plants and development of livestock industry are the factors contributing to the weed invasion.
- Some ecological disturbances like disease, fire and cleaning of land etc. made changes at micro- and macro-level, opened up niches for new alien and invasive weeds.

Invasive Weeds

- The term "Invasive" refers to those species which establish themselves in an area outside their natural range. Usually bringing changes in the function of ecosystem.
- Gause's Competitive exclusion principle:
  "The two species occupying the same niche can not survive simultaneously"
- Article 8(h) of the convention on Biodiversity (CBD) signed by 161 countries at the Earth Summit in 1992 urges the parties to "**prevent the introduction of control, or eradicate those alien species which threaten ecosystem, habitat or species**"
- Pakistan being a member of CBD, has to play its role judiciously.

Invasive weeds effect on biodiversity and indigenous local knowledge

- Invasive species have altered bio-diversity, caused economic loss and risk to human health.
- Invasive weedy species
  - cannot protect the soil, the way native plants do
  - thus erosion increases which can affect the composition of our local flora & fauna (biodiversity)
  - while some are chocking water streams, thus affecting fish population and water quality.
  - Enhance risks devastation due to climate change (floods)

Status of studies on Invasive weeds in Pakistan

- Pakistan is rich in terms of Biodiversity and is home to one of the world oldest civilization, that is Indus civilization. Thus, rich in terms of world heritage.
- Thus, keeping in view the importance of the issue concerted efforts are required to generate a good insight into the problem and suggest remedial measures.
- The research base in the country is very weak on this subject.
- Only sporadic studies have been undertaken in the past.
- The meager studies so far undertaken list 700 and 4500 species of vascular plants as alien and indigenous species, respectively (Khatoon & Ali, The Herrald annual, January 1999 after Hussain et al, 2000).

- According to this report, of these 700 alien species 5 or 6 could be recognized as high-impact invasives.
- These include;
  - 'Paper mulverry' (*Broussonetia papyrifera*),
  - 'Mesquite' (*Prosopis juliflora*),
  - 'Water hyacinth' (*Erichornia crassipes)*, and
  - 'Congress grass' (*Parthenium hysterophorus*).
- Out of these species some of the alien invasive plants species, like , *Broussonetia papyrifera* are not only reducing the land value and causing economic loss to agriculture communities but are also source of allergy and related health problems in Islamabad & Peshawar.

- Similarly the name Parthenium as allergen producing species frequently comes in the national print media (Khalid, 2002).
- The infestation of the water bodies by Eichhornia and Salvinia has not been highlighted despite its economic importance.
- Similarly, the harms of *Prospis juliflora* could be witnessed in the railway tracks and linear plantations on roads as well as in the irrigated forests and many a waste lands.

- Eucalyptus is another example highlighting the invasive behavior in farm forestry due to its aggressiveness and release of allelochemicals into the environment (Hussain et al, 2000).
- *Xanthium strumarium* and *Phragmites australis* also considered as a new emerging weeds which have invaded areas out of their natural habitat (Marwat 1993).

OBJECTIVES

- To document the response of the local community regarding spread and impact of invasive species to be deducted from the list.
- To use the indigenous knowledge of the local communities to cope with the problem of invasive weeds.
- To suggest suitable solutions regarding management of invasive species.

EXPECTED OUTCOME

- Through insight into the farmers' opinion, problem of invasive weeds will become evident.
- The impact of invasive weeds on the overall ecosystem will be exploited.
- A comprehensive list of all important weeds associated with different crops will be prepared.
- Farmers' view on change in cropping practices to cope with invasive weeds may be envisaged.
- Future collaborative projects will be developed in the light of these findings.

METHODOLOGY

- Ethnobotanical approach, using indigenous knowledge of the local communities was employed in study of invasive weeds. Survey method was used to determine the extent of invasive weeds.
- Following points were kept in mind while preparing questionnaire.

- When, why and how was the invasive species introduced locally?
- What are the drawbacks and benefits of its presence in the ecosystem?
- Is it invasive/alien weed?
- Do the animals use the plant for food and shelter? If yes, are these animals native or introduced species?

- Does the plant threaten native plant communities? If so, how?
- What can the local community do to ensure that this plant does not damage native plant communities?
- Are there any known uses/abuses of the plant in this area (e.g. medicinal values; use for fodder, fuel, spice, green salad/sag; causing allergy, or being poisonous to the animals or human, weed of crop fields, choking of irrigation streams etc.).
- Using ethnobotanical findings and field observations, the biological and ecological characteristics/behavior of such species shall also be documented.

- The questionnaire was pretested in hilly areas,viz., Nathiagali, Gora Gali, Baragali, Mochi Dara, Pasala and Tandiani.

- None of the farmers in those areas responded to invasive weeds' issues, therefore, the questionnaire was once again modified and pretested in plains including agricultural lands.
- This time the response was explicit therefore, questionnaire was finalized.
- A sample of 200 farmers was randomly selected as respondents from 16 villages, 6 near Abbotabad, 3 around Haripur, 2 near Havelian, 3 on the way from Haripur to Khanpur Dam and 2 near Tarbela/Ghazi.

- These famers were interviewed during August 2001 to March 2002, a period spread over 8 months using the questionnaire.
- During the survey personal observations were also recorded regarding the different weeds.
- The data obtained from these questionnaires and personal observations is presented in the form of Tables and discussed in the following sildes accordingly.
- Out of the total list of 36 weeds, 16 weeds were reported as invasive, therefore, their management has been suggested, while giving their descriptions.

RESULTS AND DISCUSSION

- Different farmers responded differently to the question of 5 major weeds of the area. But again interestingly the response of 200 farmers was limited to 36 weeds only.
- Out of 36 weeds
  - 14 were associated with wheat,
  - 11 with maize,
  - 10 with wastelands and roadside,
  - 9 with vegetables and only one with rice.

  Some of these weeds can be found simultaneously in more than one crop (Table 1).
- The important crops reported for this area were wheat, maize, potato, garlic, onion and perennial fruit orchards (Table 2).

- The present study was of field survey nature, the information gathered can not address the practical aspect of invasive weeds.
- The reliance has been made on date obtained from questionnaires as well as field observations.
- It is also interesting to note that invasive species were only reported from disturbed sites, mainly agricultural land. Some of the plants for example *Broussonetia papyrifera, Ailanthus altissima, Robinia pseudoca, Cannabis sativa* were from roadside areas which were again disturbed.
- The survey was conducted in several phases to cover the different seasons and in the pre-testing, only agricultural land has promise of invasive weeds therefore majority of the visit were made to famers' field in different areas.

Invasive weeds interfere with biodiversity…!

- Plants which invade an established plant community and interfere with the biodiversity, have usually prolific reproduction, wide adoptability and can escape common control measures are considered invasive.
- The evolutionary changes might have modified the genotypes resulting in more suitable ecotypes for these habitats. As shown in Table 5 famers reported a total of 16 weeds as invasive, found in crops, Wastelands, Roadside, Orchards, etc.

- The farmers' indigenous ethno botanical knowledge regarding all those 36 weeds mentioned in Table 1 is summarized in Table 3

Table 1. Weeds list based on Farmer's response to 5 major weeds of the area and their association with crops.

No	Name of Major Weeds	Family	Name of Crop	No. of Respondents	Weeds behavior
1.	Amaranthus hybridus	Amranthaceae	Maize/Vegetables	102	Increasing
2.	Ipomoen eriocarpa	Convolvulaceae	Maize	55	New introduction
3.	Commelina benghalensis	Commelinaceae	Maize	28	New
4.	Xanthium strumarium	Asteraceae	Maize/wasteland	60	New 12 years
5.	Gallium aparine	Rubiaceae	Wheat	35	New
6.	Tagests minuta	Asteraceae	Maize/wasteland	20	Old but increasing
7.	Avena fatua/ster	Poaceae	Wheat	88	Old but increasing
8.	Carhamus axyacantha	Asteraceae	Wheat/Orchards	60	Old but increasing
9.	Tulipa stellata	Liliaceae	Wheat	20	Old but increasing
10.	Silybum marianum	Asteraceae	Wheat/Orchards	30	New
11.	Achyranthus aspera	Amaranthaceae	Maize	17	Old
12.	Echinochloa colonum/crus-galli	Poaceae	Maize	28	Old but increasing
13.	Fumaria indica	Fumariaceae	Maize	23	Old
14.	Cyerus rotundus/ irria/difformis	Cyperaceae	Maize/Vegetables	44	Old
15.	Trianthema portulacastrum	Aizoaceae	Maize/Vegetables	43	New but increasing
16	Poa annua	Poaceae	Wheat/Vegetables	38	Old but increasing
17	Coronopus didymus	Brassicacaeae	Wheat/Vegetables	13	Old but increasing
18	Chenopodium murale/album	Chenopodiaceae	Wheat/Vegetables	19	Old
19	Ranunculus laetus/municacatus	Ranunculaceae	Wheat	7	Old
20	Euphorbia helioscopia	Euphorbiaceae	Wheat/Vegetables	25	Old
21	Sorghum hellapense	Poaceae	Maize/Orchards	30	Old but increasing
22	Cannabis sativa	Cannabaceae	Wasteland	5	Old but increasing
23	Datura alba	Solanaceae	Wasteland	3	Old
24	Convolvulus arvenis	Convolvulaceae	Maize/Orchards/wheat	46	Old but increasing
No.	Name of Major Weeds	Family	Name of Crop	No. of Respondents	Weeds behavior
25	Alternanthera pungens	Amaranthaceae	Vegetables	2	Old but increasing
26	Malvastrum coromendalianum	Malvaceae	Wasteland	1	Old
27	Emex spinosus	Polygonaceae	Wheat	20	New
28	Broussonetia papyrifera	Moraceae	Wasteland/Roadside	1	10 years old
29	Robinia psuedoacacia	Papilionaceae	Roadside	10	Foresters planted it
30	Ailanthus altissima	Simarubaceae	Roadside	4	Foresters planted it
31	Sisymbrium irio	Brassicaceae	Wasteland	8	Old but increasing
32	Pistia stratiotes	Araceae	Rice	Personal observation	New, future weed of rice
33	Phragmites australis	Posceae	Wheat	Personal observation	New
34	Imperata cylindrica	Poaceae	Wheat	5	Old but increasing
35	Cynodon dactylon	Poaceae	Ubiquitous weed	38	No shift reported
36	Parthenium hysterophorus	Asteraceae	Roadside	Personal observation	Recent

- Major crops reported during the survey were wheat, maize, garlic, potato, onion and fruit orchards, and their 5 major weeds were enlisted in Table 2.

- The most commonly reported weeds of major crops:
- Wheat were *Galium aparine, Avena* Sp., *Carthamus oxyacantha, Tulipa stellata, Silybum marianum, Fumaria indica, Euphorbia helioscopia, Convolvulus arvensis, Lolium multiflorum,*
- Maize weed were *Amaranthus* Spp.*Impomoea eriocarpa, Commelina benghalensis, Xanthium strumarium, Achyrathus aspera, Echinochloa* Spp., *Sorghum helipense, Convolvulus arvensis, Trianthema portulacastrum* and *Tagetes minuta*,

- The most commonly reported weeds of major crops:
- Weeds of potato were *Fumaria indica, Cyperus* Sp., *Poa annua, Coronopus didymus, Euphorbia helioscopia.*
- Reported weeds of Garlic were *Amaranthus* Sp., *Fumaria* Sp., *Cyperus* Sp., *Trianthema portulacastrum, Poa pretense, Coronopus didymus, Chenopodium* Sp., *Euphorbia helioscopia*; and the only weed reported in rice was *Pistia stratiotes* (Table 1)

Table 2. Major crops along with important weeds reported during the survey.

S #.	Crop names	No of respondents	5 major weeds
1	Wheat	110	*Gallium aparine, Avena fatua/sterilis Carthamus oxyacantha, Silybum marianim, Convolvulus arvensis*
2	Maize	120	*Amaranthus spp, Imomoea eriocarpa Xanthium strumarium Cyperus spp Sorghum helapense*
3	Garlic	54	*Cynodon dactylon Cyperus spp Trianthema portulacastrum Poa anna Euphorbia helioscopia*
4	Potato	60	*Amaranthus Cyperus rotusdus/difformis Trianthema porfulacastrum Poa annua Euphorbia helioscopia*
5	Onion	28	*Fumaria indica Amaranthus viridis Cyperus rotusdus Poa annua Euporbia helioscopia*
6	Orchards	25	*Cynodon dactylon Sorghum helapense Carthamus oxyacantha Silybum marianum Convolvulus arvensis*

Table 3i. Indigenous Local knowledge about use of important weeds of Abbottabad district.

No.	Name of Weed	Ethno botanical use/Comments/ILK
1	*Amaranthus hybridus*	It becomes very tall at end of growing season. Population increases with FYM., used as saag/pot herb.
2	*Ipomoae eriocarpa*	Very competitive with maize, used as fodder.
3	*Commelina benghalensis*	Farmers complain with of it as a competitive weed and a recent introduction, used as fodder.
4	*Xanthium strumarium*	Recently introduced plant, further increase with FYM. They think that it came with the sheep, found in waste place and maize fields- increasing day by day.
5	*Gallium aparine*	Recently introduced, early competition with wheat.
6	*Avena fatua/sterilis*	Very common competitive weed in wheat, also used as fodder. Introduced with wheat seed.
7	*Carthamus oxyacantha*	Seed come with wheat. Seed eaten by children, create harvest problem in wheat.
8	*Tulipa stellata*	Children eat it – cultivated in gardens.
9	*Silybum marianum*	Seed used in dyspepsia and digestion very competitive, recent introduction in relatively plains (Haripur and Havalian).

Table 3ii. Indigenous Local knowledge about use of important weeds of Abbottabad district.

No.	Name of Weed	Ethno botanical use/Comments/ ILK
10	*Tagetes minuta*	Problem in waste places, mostly untilled – tall upto 2 meters. Used in seasoning of soups.
11	*Achyranthus aspera*	Competition with maize but mostly on borders of field, fruit stick to clothes.
12	*Fumaria indica*	Medicial plants, weed of wheat.
13	*Echinochloa Spp.*	Problem weed of maize fields, used as fodder, birds prefer its seed.
14	*Cyperus rotundus*	Comes in maize soon after rain. Stem tuber edible, kids like it.
15	*Trianthema portulacasatrum*	Very serious weed of vegetables & maize. Considered a spiritual plant against jaundice.
16	*Poa annua*	Early season., winter weed of wheat, used as fodder.
17.	*Coronopus didymus*	Weed of wheat – Brings had odor in cattle's milk. Inset repellant.
18.	*Chenopodium album/murale*	Seeds used as detergent for washing hair and clothes in villages.
19.	*Ranunculus laetus*	Weed of wheat, poisonous to cattle.

Table 3iii. Indigenous Local knowledge about use of important weeds of Abbottabad district.

No.	Name of Weed	Ethno botanical use/Comments/ILK
20.	*Euphorbia heliosepia*	Poisonous, weed of wheat.
21.	*Sorghum helapense*	Very aggressive weed (perennial) of maize fields. Poisonous to cattle.
22.	*Cannabis sativa*	Found in waste places, used as drug, fiber, used against malaria, anthrax and dysentery (Zaman & Khan, 1970).
23	*Datura alba*	Poisonous, few seeds can cause abortion.
24.	*Canvolvulus arvensis*	Used as poultice for painful joints.
25.	*Alternanthera pungens*	Sticky fruits, its decoction relievers itching skin.
26.	*Malvastrum coromendalianum*	Smelling roots helps prevent vomiting.
27.	*Emex spinosus*	Cause harvest problem in wheat fields.
28.	*Broussonetia papyrifera*	Source of allergy, used for fuel purposes.
29.	*Robinia psuedoacacia*	A quick growing tree, young twigs used as fodder, food for fuel.

Table 3iv. Indigenous Local knowledge about use of important weeds of Abbottabad district.

No.	Name of Weed	Ethno botanical use/Comments/ILK
30.	*Ailanthus altissima*	A quick growing tree, young twigs used as fodder, good for fuel.
31.	*Sisymbrium irio*	The whole plant is used as repellent against insects.
32	*Pistia stratiotes*	A new emerging weed, can become a future problem weed of rice and aquatic habitats. It serves as host for mosquitoes, which help in spread of malaria.
33.	*Phragmites australis*	Young twig used as fodder, Culm is used in pipes for smoking tobacco.
34.	*Imperata cylindrical*	A weed of perennial crops and less disturbed habitats.
35.	*Cynodon dactylon*	Used as fodder. Used as astringent, diuretic and styptic (Baluch et al., 1968).
36.	*Parthenium hysterophorus*	Causes allergy, cause cattle disorders (Khalid, 2000).

- During the survey, farmers mentioned different constraints related to their farming;
  - the most common problem reported by 180 farmers was the weeds' problem,
  - followed by irrigation water,
  - lack of incentives to the farmers (high input vs low output),
  - lack of contacts with agricultural extortionists.

The other problems faced by the farmers were non-availability of inputs/agricultural machinery, pests floods/rains, harsh weather and involvement of female farmers in housekeeping etc. (Table 4).

Table 4. Major problems of the farmers

Type of constraint/problem	Number of respondents
Weeds problem	180
Water/irrigation/scarcity	140
Water logging	6
Seed of good quality is not available	40
Insects	15
Diseases	15
Fertilizer	50
Floods after rain	10
Herbicide/Agrochemicals: chemicals not available	55
Tractor/machines not available	45
Chilling whether/frost	5
Lodging	5
Lack of incentives towards farming	90
Lack of Agri. Extension Education (high input low output).	80
Female famers can't afford labour due to domestic assignment.	50

Table 5. Farmer's response to invasive weeds

Name of the weed	How became invasive	Remarks
Xanthium strumarium (15)	Through sheep and Goats/FYM	Came from Northern Afghanistan through sheep and goats.
Impmoea eriocarpa (2)	FYM/Fodder	FYM seem cause of its spread.
Alternanthera pungens (1)	Through seed of vegetables & goats (sticky fruit).	Grazing animals and FYM is the cause of its spread.
Trianthema portulacastrum (10)	Through seed of vegetable	Biggest problem of vegetables problem.
Tagetes minuta (2)	Wind/Seed/Farm machinery	Very tall, insect repellant.
Imperata cylindica (2)	Wind	Troublesome weed of perennial orchards & un-disturbed soils.
Amaranthus hybridus (10)	Birds, wind, FYM	Very tall, used as pot herb.
Robinia pseudoacacia (7)	Cultivation along road	It is spreading along road side & replacing local trees.
Broussonetia papyrifera (2)	Cultivation/Birds	Found near Tarbela (Personal observation).

* Through personal observation in the field.
Note: Figures in parenthesis denote the number of respondents.

Table 5. Farmer's response to invasive weeds

Pistia stratotes *	not known	Found near Tarbela (Personal observation).
Phragmites australis *	not known	Fiber recovery weed.
Parthenium hysterophorus *	not known	Used as repellent
Cannabis sativa (11)	Through FYM and fuel use.	Used in drugs, sedative, has cooling effect.
Galium aparine (5)	Through wheat crop seed and sticky nature of plant	Competitive with wheat.
Emex spinosus (2)	Through wool of sheep and goats	Competitive with wheat.

* Through personal observation in the field.
Note: Figures in parenthesis denote the number of respondents.

CONCLUSIONS AND RECOMMENDATIONS

- It was an endeavor with the challenge to complete a vast study in a short period, with a meager research basis in this discipline.
- Because of the complexity of the problem, work on invasive weedy species was readily discouraged.
- Although it is generally understood that invading plants are a threat to conservation of biodiversity.
- Legislation is required to discourage introduction of alien species, which can pose a major threat to the environment in the future.
- Not all the farmers interviewed could answer the questions, but most of them yielded an important part of information through their years-old experience acquired from their ancestors.

1. *XANTHIUM STRUMARIUM* L. (Family *Asteraceae*)

Common name: Common cocklebur

2. IMPOMOEA ERIOCARPA R.Br., (Family *Convolvulaceae*)

Common name: morning glory, Ilra

3. ALTERNATHERA PUNGENS Kunth (Family *Amranthaceae*)

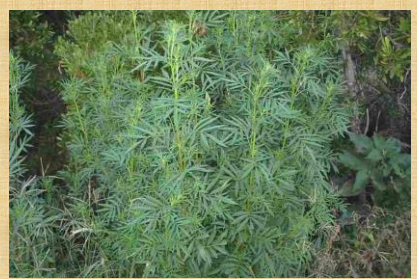
Common Name: It-sit, (Farmers confuse it with *Trianthema portulacastrum*)

4. TRIANTHEMA PORTULACASTRUM L. (Family *Aizoaceae*)

Common name: Desert horse purslane, black **pigweed**, and **giant pigweed,** Wisak, it-sit.

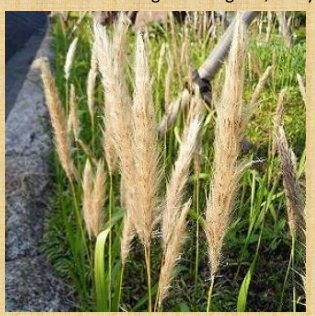
5. TAGETES MINUTA L. (Family *Asteraceae*)

Common name: Gul-e-Sadbarg, Mexican marigold.



6. IMPERATA CYLINDRICA , (Family *Poaceae*)

Common name: Engl. Sword grass, Blady grass, Cogon grass.



7. AMRANTHUS HYBRIDUS L., (Family *Amaranchaceae*)

- Common names: Eng: Prince of wales, Hindko: Chalwera.

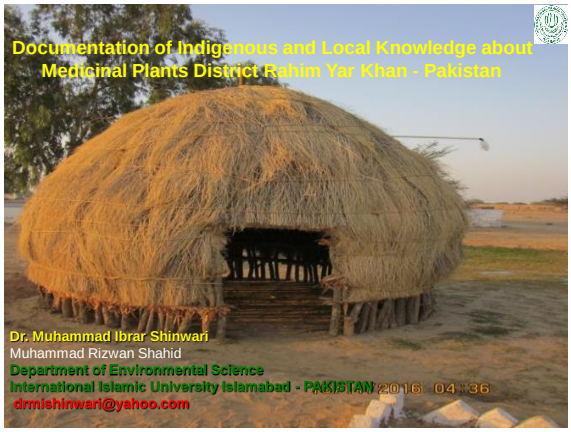
8. ROBINIA PSEUDOACACIA Linn. (Family Papilionaceae)

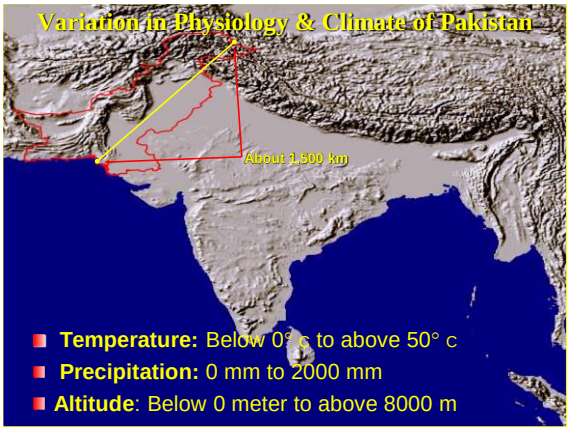
Common Name: Black Locust

9. BROUSSONETIA PAPYRIFERA Vent. (Family *Moraceae*).

Common name: Paper mulberry, Gul toot

Thank you





BOTANICAL DIVERSITY IN PAKISTAN
WITH REFERENCE TO
MEDICINAL PLANTS / INDIGENOUS LOCAL KNOWLEDGE AND THEIR HABITATS

Total number of Flowering Plant Species: 6000

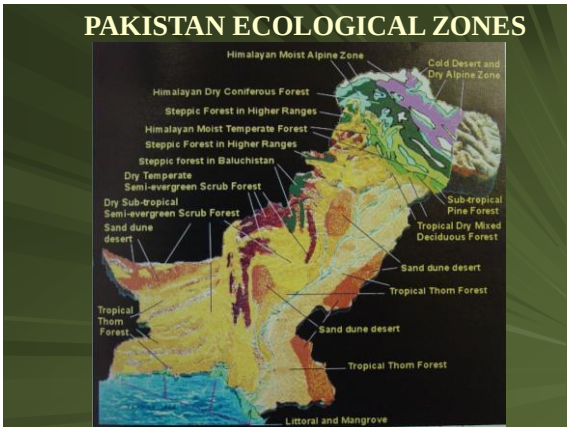
Total number of Endemic Flowering Plants: 425 (7.8%)

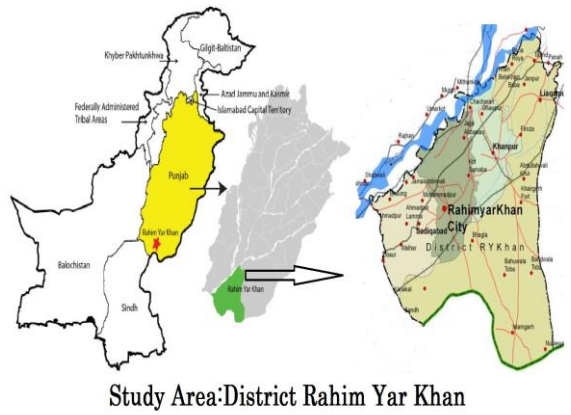
Total number of Medicinal Plants: 2000

Plant Species used as medicine: 600 (10%)

Total number of Ecological zones: 18

Total number of Cultures: 15





INDRODUCTION
Study Area: Rahim Yar Khan Punjab - PAKISTAN

I. **Location/ Area/ Population/ Ethnicity/ Culture**
- 27° 40'-29° 16' northern latitudes and 60° 45'-70° 01' eastern longitudes
- 11,880 square kilometers
- Total population: 3.3 million. (19.6 percent living in urban area)
- The major tribes in the clony area are the Arain Jat, Rajput and Gujjar.
- The old settlers are the Joya, Wattoo, Daudpota, Balouch, Syed and Pathan
- In Cholistan area the Bohar, Lark, Bhen, who came from Arabia to preach Islam
- The Jats and Rajputs came from Rajputana and Jaisalmir and converted to Islam in the reign of Feroz Shah Tughlak

Diverse culture as its inhabitants 45% are Punjabi, 51% are Siraki, Sindhi and Balochi and while 0.9% cholistani. (ASER Pakistan, 2008)

II. **Geographical Zones**
- 1. Riverine area 2. Canal irrigated area 3. Desert area

III. **Climate and Rain Fall**
- Climate is hot and dry in the summer (April to October), on the other hand cold and dry in the winter season (November to March)
- The average rain fall is about 100 millimeter

Vegetation near Qasr-e-Abudahbi, Rahim Yar Khan

Hypothesis

Objectives

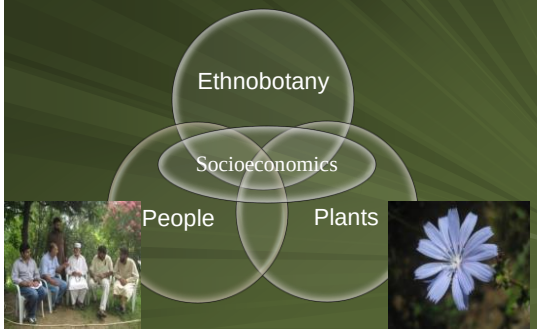
- To document the Indigenous Local Knowledge about medicinal plants and trigger a data-base development
- To report new as well as rarely reported medicinal properties of medicinal plants
- To evaluate the medicinal value of the selected plants used by the local people as herbal medicine

Methodology

- Ethnobotanical Field/ Market Surveys
  - October 1st 2015 to November 20th 2016
  - Selected sites: 4
    (Qsre-Abu Dahbi, Chowk Shabaz Pur, Chani Goth and Head Malkani Zahir Pir)
  - Collected data from 70 local herbalists/ hakims by adopting a Questionnaire/ interviews
  - Socioeconomic value have been evaluated by market survey of 16 local Pensar stores and Dua Khanas
- Evaluation of Medicinal Value (Two formulas)
  - Relative Frequency of Citation (RFC)
  - Second one is Medicinal Use Value (MUV)

$$MUV = \sum \frac{XMUi}{N}$$

Assessment Approach



Overall Results

- About 100 Local recipes composed of a total of 78 medicinal plant species were recorded belonging to 33 families and 66 genera at 4 study sites
- Out of the 78 species 34 species are herbs, 9 are shrubs and 35 species are trees
- Plant species Occurrence:
  34 Dominant, 22 infrequent and 21 rare
- The share of Indigenous/ local Knowledge documented:
  - Local Hakims (71 plants)
  - Homopathists (23 plants)
  - Local people knowledge from Tib-e-Nabvi (11)

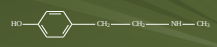
Common Tree:
Acacia jacquemontii Benth.(Kiker)

Common Shrub:
Calotropis procera Linn (Ak)

Observations: Saline and water logged area near Dadi Karam Khatoon Rahim Yar

Invasive Species Prosopis glandulosa
Mesquite
Mimosaceae

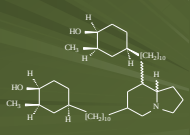
Life form: **Deciduous tree or large shrub**
Origin: **West Indies and Mexico**
Mode of introduction: **For afforestation to the deserts of Sind and Punjab.**
Affected Areas: **Punjab, Sindh (riparian forest) and Baluchistan (Juniperus forest).**
Harmful impact: **Environment (Native flora especially Acaia nilotica and Juniper)**
Allelochemical: **Phenolic compounds?**



N-methyl Tyramine

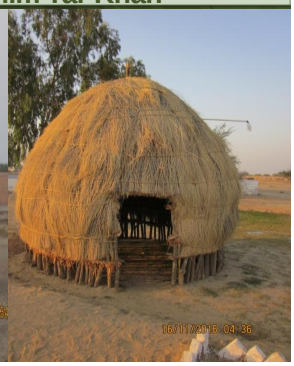
Invasive Species P. Juliflora
Mimosaceae

Life form: **Deciduous tree or large shrub**
Origin: **Southern United States and Northern Mexico**
Mode of introduction: **For afforestation to the deserts of Sind and Punjab.**
Affected Areas: **Punjab, Sindh (riparian forest) and Baluchistan (Juniperus forest).**
Harmful impact: **Environment (Native flora especially Acaia nilotica and Juniper)**
Allelochemical: **Alkaloid (Juliflorine)**



Juliflorine

Cultural diversity at dessert area site near Qasr-e-Abudahbi Rahim Yar Khan



Specimen collection at Head Malkani Zahir Pir Head Malkani

Bombax ceiba (Sumbal) ***Cordia dichotoma Forster.*** **(Lesora)**

Specimen collection at Head Malkani Zahir Pir Head Malkani

Eucalyptus camaldulensis **(Sufaida)** *Morus nigra* (toot)

Allium sativam (Lehsen)
Aloe vera (L.) Burm. (Kanwar Gandul)

Used against Anorexics Abodominal pain, Hepatitis and Splenomegaly.

Hakeem Abdul Rehman Waseeh, Natural clinic R.Y.Khan

• *Moringa oleifera* Lam.(Suhanjna)

Used against Body pain, gastric problems and keep blood pressure normal

Hakeem Abdul Rehman Waseeh, Natural clinic R.Y.Khan

Cichorium intybus **L. (Kasni)**

Used as anti-diabetic remedy

Hakeem Abdul Rehman Waseeh, Natural clinic R.Y.Khan

•*Allium sativam* (Lehsen) and *Citrus limon* L. *Burm.f.* (Lemon)

Used to maintain the cholesterol level and the blood pressure level normal

Hakeem Abdul Rehman Waseeh, Natural clinic R.Y.Khan

Threats to Indigenous Local Knowledge and Ethno-botanical diversity?

1. Conservation Threats
   - Lack of Indigenous Local Knowledge Documentation
   - Urbanization
   - Sustainable Utilization of Wild MPs
   - Habitat degradation
2. Taxonomic Threats
   - Nomenclature Ambiguities
   - Lack of Indigenous Local Knowledge Documentation
   - Lack of Scientific Knowledge Application
3. Administrative Threats
   - Unorganized Trade
   - Lack of Scientific application
   - Quality of Raw Material
   - Intellectual Property Rights

Threats to Indigenous Local Knowledge and Ethnobotanical diversity?

4. Physical Threats:
   - Converting land to agriculture
   - Clearing forests
   - Climate change
   - Industrial Pollution
   - Unsustainable harvesting of natural resources
   - Introduction of alien invasive species in the area

CONCLUSION

Future Vision

- Documentation of Indigenous Local Knowledge about Flora of Pakistan and database development
- Development of local, National and Regional/ Sub-regional Network for Indigenous Local Knowledge
- Quantitative assessment of Ethnobotanical Species: Focus on Inventory of the District Flora
- Coordinated In-situe/ Ex-situe/ In vitro Conservation Trails of threatened/ endangered species
- Database of Invasive Plant Species and their control
- Development of Techniques to reduce Post harvest losses in Medicinal Herbs/ Fruits

Biological diversity and Cultural Diversity goes together

79

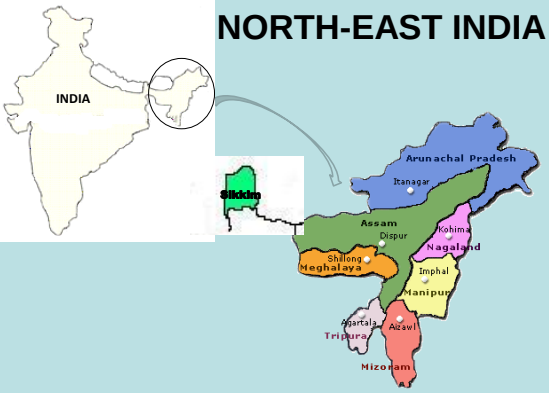
Outline of Presentation

- About Traditional Knowledge
- About the-North-East: People and Natural Resources
- TK based NRM
  - Forest ecosystems
  - Agro-ecosystem/Shifting Agriculture
- Conclusions and Lessons learnt

Traditional Knowledge

- **The wisdom held and shared by the community, and passed down from generation to generation**
- **This varies from NRM to technologies, farming methods to medicine and anything else that is important to a particular community.**
- **Indigenous/traditional methods are often more appropriate for the local environment and conditions**

NORTH-EAST INDIA



North East India at a glance

- **8 States, 45 Million people**
- **Geo. Area: 8% of India's Geo. Area (2,62,159 sq km)**
- **2/3rd Upland, 1/3rd Lowland**
- **Immense Cultural Diversity with over 200 ethno-linguistic communities,**
- **50% of India's Biodiversity, High endemism**
- **66.29 % of Geographical Area under forest cover (173780 sq km, FSI, 2009)(25% of India's Total Forest Cover)**
- **Prevalence of strong Traditional Institutions & TK based livelihoods**
- **Economy is basically Agriculture, supplemented by limited Horticulture, Animal husbandry, forestry and Crafts production.**

Traditional Knowledge based NRM Systems some examples….

- **Management of Forests in Mawkyndeng village, Meghalaya**
- **Forest Gardens of Meghalaya**
- **Safety & Supply Reserves of Mizoram/Meghalaya**
- **Village Forests of Nagaland**
- **Bun Cultivation of Meghalaya**
- **Apatani system of NRM, Arunachal Pradesh**
- **Bamboo drip irrigation of Khasi Hills, Meghalaya**

Traditional Knowledge based NRM Systems continued…

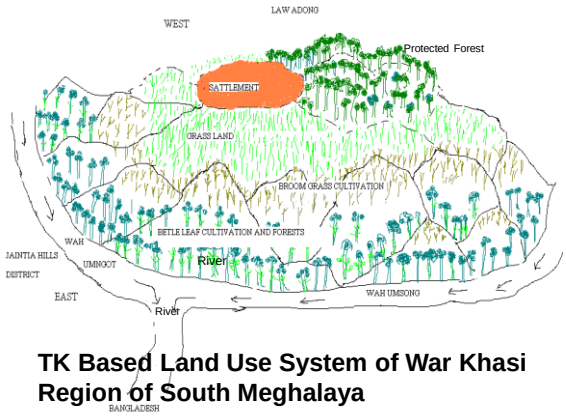
- Disease & Pest management of Betel Leaf growers of Meghalaya
- Twining of Honey Bee rearing & Orange orchards in southern slopes of Meghalaya
- Bamboo groves of Jamatias of Tripura
- Sacred groves of Meghalaya

TK based Creation and Management of Forest Gardens

Forest Gardens of Southern Meghalaya:
as they look from a distance

Conservation of forests for water

Water tanks supplying water to village Siatbakon, Meghalaya



TK Based Land Use System of War Khasi Region of South Meghalaya

Typical Hierarchy of Traditional Institutions in Khasi Hills

HIMA (Larger Territory)
SYIEM HIMA (King/Care Taker)

RAID (Smaller Territory)
SYIEM RAID
(King/Care Taker of a Province)

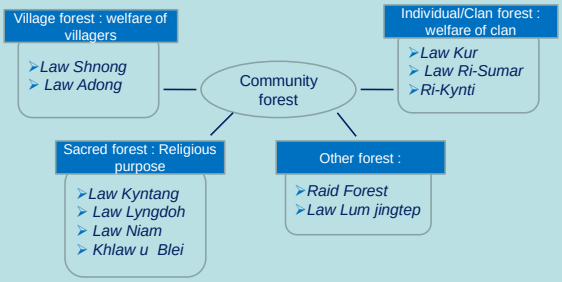
SHNONG (Village)
RANGBAH SHNONG (Village Headman)

KUR (Clan)
RANGBAH KUR (Clan Head)

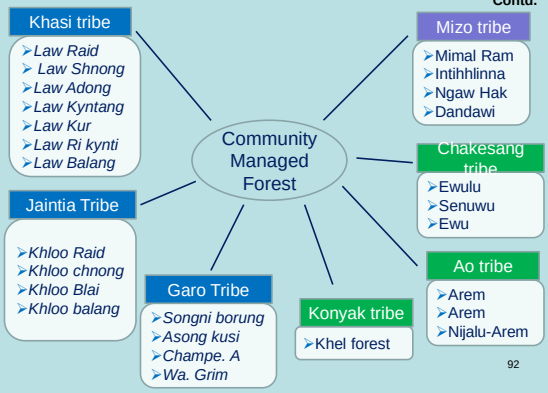
IING (Family)

TK Based local Governance

TK Based Classification of community forests: A near perfect example of production and protection forestry with in built concept of equity



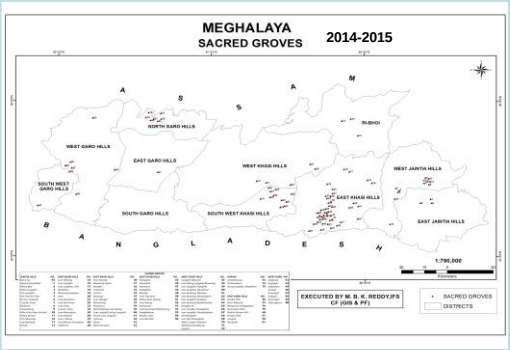
TK Based Classification of community forests Contd.



92

TK Based Forest Management

- **Forest Types:** Village forests, Raid forests, Clan forests, Sacred forests
- **Institutional Arrangement**: Durbar (Clan, Village, Raid, Syiem,), Council of Myntri, Chief
- **Management intervention:** Social Fencing, Need based selective extraction/felling, Fire line/ Controlled Grazing



Sacred Groves of Meghalaya

- Sacred groves are mostly large patches of forests protected by the people based on religious beliefs hence more appropriately called as **SACRED FORESTS**
- Sacred groves are viewed as CULTURAL IDENTITY and relic of traditional religion of the Khasi and Jaintia tribes of Meghalaya
- Sacred groves are found all over the state
- **Owned/managed by village or clan council, traditional chiefs** of elaka They are out side Govt control, managed by communities
- Taxonomy and ecology of SGs quite well studied *vis a vis* other states of India

Phytodiversity Conservation Value of SGs

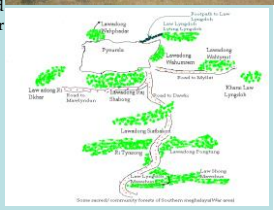
- SGs cover approx. 1000 sq km area (Approx.4%of GA)
- SGs +other Community forests account for 90% of state's forest
- Only 1046.99 sq km under PA+RF in Meghalaya (Govt. managed)
- **A large no of SGs are on elevation >1500m and rainfall 600-1200cm**
- **Except 2 small RFs no PAs on elevation >1500m & nil in areas of extreme rainfall**
- 133 sp found **only** in SGs out of which 96 are Endemic to Meghalaya
- Total sp of angiosperms recorded from SGs: 514 (Range 450-200, 80-160 tree sp/SG)
- Size of Sacred Groves: 2ha to 900ha

Ecosystem Services from SGs

- SGs are **repository of Biodiversity** of state which is central to the production of ecosystems services.
- **Provisional :** Food, fiber, fish, freshwater for drinking and agriculture
- **Cultural:** Rites rituals, Religious beliefs, tourism, heritage value, community cohesion, education
- **Supporting:** Soil formation and retention, provision of habitat for native vegetation and fauna
- **Regulating:** Carbon storage and sequestration, water flow regulation, leaf decomposition, River catchment protection

Watershed Protection

- Out of 79 SGs in Meghalaya, 66 were located on the **catchments areas of major rivers** and rivulets (Tiwari et al 1998).
- 58 S.Gs. (9621 ha) are located at the **origin of perennial streams**.
- Large & Dense groves can **withhold hundreds of centimeters of water** and release it through the springs on lower slopes and in valleys.
- Several rivers of the state originate from the sacred groves.
- SGs conserve soil & nutrient in fragile ecosystems
- People of rural Meghalaya heavily depend on the forests for **potable water** and soil moisture.



Most S.Gs are found on Summits of hill, steep slopes, origins of water sources etc

Law Adong Phod Jaud, South West Khasi Hills
Area - 63.71 Ha
Altitude -1424 m

Mawphlong Sacred Grove 80 ha

Traditional societies have been conserving forests for 'ecosystem services' since time immemorial

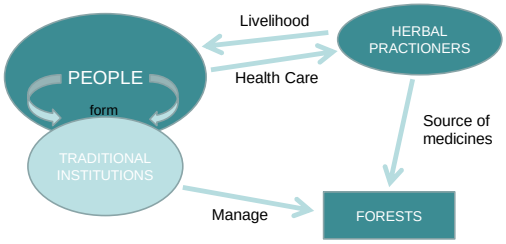
hundreds of years before the term was coined by the modern ecologists

A View of Pongtung Law Adong

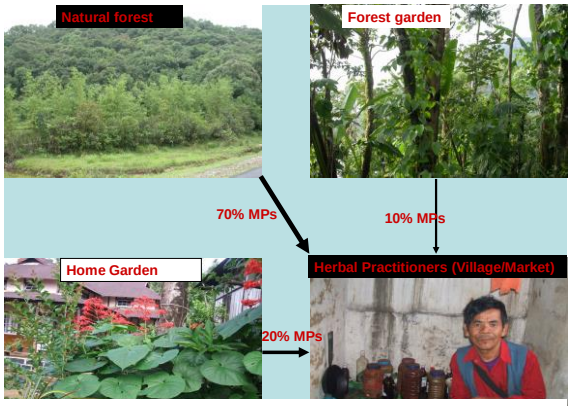
A View of Siatbakon Law Adong

A View of Cemetry forest of Lankon

A View of Pynursla Law Adong



T K Based Health Care System



Sources of Med. Plants collected by the Herbal Practitioners

Herbal practitioner at Jingjal Market of West Garo Hills District

Two forest management systems

TK Based Management

- Peoples' participation
- Equitable/gender
- More sustainable
- Local need based
- NTFP & M.P.
- Promotes Social cohesion
- Less sonflict
- Less external input

Modern Management

- Government activity
- Favours to the rich/
- Less sustainable
- Outsiders interests
- Timber based
- Less social benefit
- More conflict
- High external input

Creative integration of TK based technological knowledge leading to livelihood improvement of shifting cultivation practicing communities of north-eastern India

SOME EXAMPLES…..

Cultivation of crops on contours

Nongching village, Mon district of Nagaland (Konyak Tribe)

Macaranga denticulata saplings in shifting cultivation plots

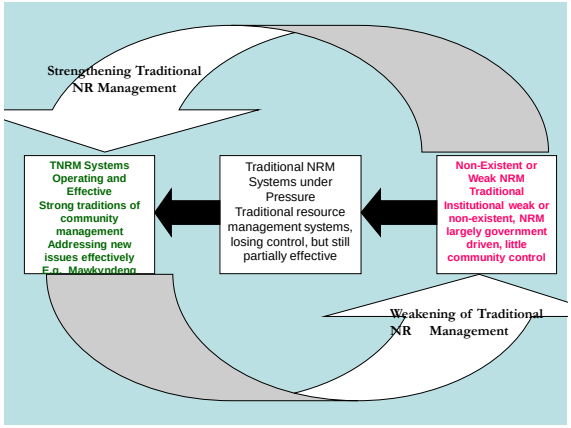
SC Fallow with *Macaranga denticulata*

Lessons learnt

- **Traditional k*nowl*edge helps in conservation of natural resources.**
- **Traditional knowledge could be blended with modern principles of conservation and management of natural resources. E.g Mawkyndeng Village, West Khasi Hills**
- **Natural Resources and TK are interrelated and interdependent for perpetual existence**
- **Conservation of traditional knowledge is important for conservation of natural resources**

Conclusions

- **TK based NRM is based on the wisdom held and shared by the community, and passed down from generation to generation and thus time tested**
- **TK based management are more inclusive, equitable and therefore sustainable**
- **Traditional land use and production systems are often more appropriate for the local environment and conditions than technologies suggested by outside experts.**
- **With the world changing so quickly, traditional NRM systems can be easily lost, so it is required to preserve it.**
- **Communities are constantly innovating and improving their production systems**
- **Traditional management systems need to be judiciously blended with modern principles of conservation and management of natural resources.**



Acknowledgements

My Research Students who helped me in documenting the knowledge
Local People who shared their knowledge
Funding Agencies: CFI USA, IDRC, Canada, CIFOR, Indonesia

Further Readings….

- **Tiwari, B. K.,** H. Tynsong, and M.B Lynser 2010. Forest management practices of the tribal people of Meghalaya, North-East India. *Journal of Tropical Forest Science*, 22 (3) 127-139.
- Tynsong H. and **Tiwari, B.K.**, 2007. Traditional Ecological Knowledge (TEK) associated with fish harvesting practices of *War Khasi* community of Meghalaya, India. *Indian J. Traditional Knowledge* 7(4) 618-623.
- **Tiwari, B.K.**,2007. Shifting agriculture in northeastern India: some insights in spatio-temporal patterns and processes Shifting cultivation in Asia (Eds K.G. Saxena et al) Bisen Singh Mahendra Pal singh, New Delhi.
- Karki, M., **Tiwari, B.K.**, Badoni A. and Bhattarai N. (2005) Creating livelihoods and enhancing biodiversity-rich production systems based on medicinal and aromatic plants: preliminary lessons from South Asia. *Acta Horticulturae* (ISHS, Leven, Belgium) 678:37-43.
- **Tiwari, B.K.** (2006) Conservation of Natural Resources and sustainable Development In (O.P. Singh Ed) *Environment and Natural Resources Ecological and Economic Perspectives*, New Delhi: Regency Publications, p. 81-100.
- **Tiwari, B.K.** (2006) Environmental Goods and Services, In (O.P. Singh Ed) *Environment and Natural Resources Ecological and Economic Perspectives*, New Delhi: Regency Publications, p. 14-33.

Further Readings….

- Upadhaya A. , S.S. Chaturvedi, **Tiwari B.K.** 2016. Utilisation of wild Citrus by Khasi and Garo Tribes of Meghalaya. *Indian Journal of Traditional Knowledge* 15 (1): 121-127
- Oberlack C, La Haela Walter P, Schmerbeck J, **Tiwari B. K.** 2015. Institutions for Sustainable Governance of Forests: Equity, Robustness and Cross-level Interactions in Mawlyngbna, Meghalaya, India. *International Journal of the Commons* 9(2), 670-698.
- Deb S., Marbakor Mary Lynrah · **Tiwari B. K.** 2013. Technological innovations in shifting agricultural practices by three tribal farming communities of Meghalaya, northeast India *Tropical Ecology* 54(2):133-148
- **Tiwari B. K.**, Tynsong, H., Lynrah, M. M.,Lapasam, E., Deb, S. and Sharma, D. 2013. Institutional arrangement and typology of community forests of Meghalaya, Mizoram and Nagaland of North-East India. *Journal of Forestry Research* 24(1): 179−186
- **Tiwari, B**.K. and Tynsong, H. 2012. Traditional knowledge based forest management: the case of War tribe of Meghalaya, India. In: (K.G. Saxena, Luohui Liang, Koji Tanaka, Shimako Takahashi Eds) *Land Management in marginal Mountain Regions: Adaptation and Vulnerability to Global change*, Bishen Singh Mahendra Pal Singh, Dehra Dun, p 143-157
- Tynsong, H., Dkhar, M. and **Tiwari B. K.** 2012. Traditional knowledge based management and utilisation of bioresources by war khasi tribe of Meghalaya, North-east India. *Indian J. Innovations Dev.* 1: 162-174.
- Tynsong, H and **Tiwari B. K**. And Dkhar, M. 2011. Bird hunting techniques practiced by of War Khasi Community of Meghalaya, North-east India. *Indian Journal of Traditional Knowledge* 11:334-341

Further Readings….

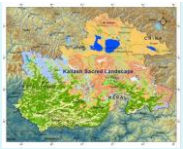
- Poffenberger, M., Barik, S.K., Choudhury, D., Darlong, V., Gupta, V., Palit, S., Roy, I., Singh, I., **Tiwari, B.K.** and Upadhayay, S. (2007). Indigenous Forest Stewards of Northeast India, 64p. Community Forestry International, USA.
- **Tiwari, B.K.** Barik., S.K. and Tripathi., R.S. (1998) Sacred Groves of Meghalaya. In: (Ramakrishnan, P.S. et al Ed.) Conserving The Sacred for Biodiversity Management p. 253-262, UNESCO, Oxford IBH, New Delhi.
- Tiwari, B.K., Barik., S.K. and Tripathi., R.S. (1998) Biodiversity Value, Status and Strategies for Conservation of Sacred Groves of Meghalaya, India. *Ecosystem Health*, 4: 20-32.
- **B.K. Tiwari,** M. M. Lynrah and S. Deb (2014) Innovations in shifting cultivation by three indigenous groups in Meghalaya, India. In: Malcolm Cairns (Ed) *Shifting Cultivation and Environmental Change, Indigenous People, Agriculture and Forest Conservation*. 1-18. Routledge: Taylor and Francis
- **B.K. Tiwari (**2014) Temporal changes and innovations in raised-bed shifting cultivation at higher elevations in Meghalaya, Northeast India. In: Malcolm Cairns (Ed) *Shifting Cultivation and Environmental Change, Indigenous People, Agriculture and Forest Conservation*. 19-33. Routledge: Taylor and Francis
- **B.K. Tiwari,** R. S. Tripathi and. S.K. Barik (1999) *Sacred Forests of Meghalaya Biological and Cultural Diversity*, Regional Centre NAEB, NEHU, Shillong 102p, .
- K.S. Rao, K.G. Saxena and **B.K. Tiwari (**2016) *Biodiversity, Climate Change and Socio-Economic Development in the Indian Himalaya: An Overview*, Bishen Singh Mahendra Pal Singh, Dehra Dun 80 p

Cultural and Economic Value of Himalayan Giant Nettle (*Girardinia diversifolia* (Link) Friis) in Eastern and Western Regions of Nepal

by
Bijay Raj Subedee
Ram Prasad Chaudhary
Research Centre for Applied Science and Technology,
Tribhuvan University

Introduction

- The Himalayan Giant Nettle (*Girardinia diversifolia* (Link) Friis)
- Family: Urticaceae
- Locally Known as 'allo'
- One of the fiber bearing plant species of Nepal.
- Study area: Kailash Sacred landscape (KSL), Makulu-Barun National Park and Conservation Area.



Research question

What is the importance of *Girardinia diversifolia* in culture and economy for the indigenous and local communities of eastern and western regions of Nepal?

Objective

- To document cultural and economic importance of (*Girardinia diversifolia)* in eastern and western regions of Nepal.

Methodology

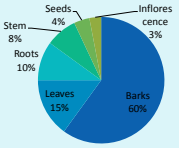
- Focus group discussion
- Informal meetings
- Field observations
- Semi-structured questionnaire

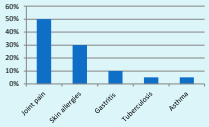
- Indigenous and local community (ILCs) such as Kulung Rai from Sankhuwasabaha district andThagunna, Bohora, Manyal living in Api Nampa Conservation Area (ANCA) of Darchula district, use fiber from ancient period. porter strap (*Namlo*), rope for a domesticated animal(Damlo), coat, pant, bag, shawl, purse and many more items.

Results

- Different parts of the plant are traditionally used by local healers (Baidhya and Dhami)

Parts	Uses recorded from present study
Roots	Juice of roots is used for treating gastritis, constipation and applied in swelling. Paste of root applied in joint pain. Root juice is used for stomach ache with water
Barks	Fiber obtained from the bark are applied for production of different articles such as ropes, fishing nets, bags, sacks clothing materials, weaving rugs, jackets.
Leaves	Juice of leaves given in headache, joint aches, tuberculosis and for asthma. Used as a vegetable
Stem	Heated and applied in joint pain.
Inflorescence	Bone fracture
Seeds	Use in headache. Seeds has to mix with water but restricted to mix with oil and ghee.

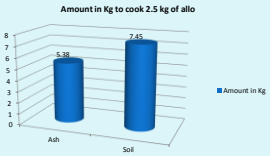


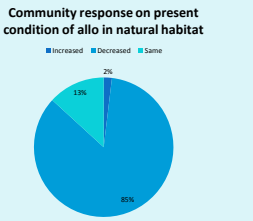


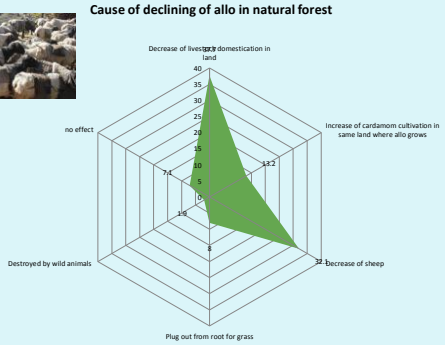
Processing method followed by ILCs

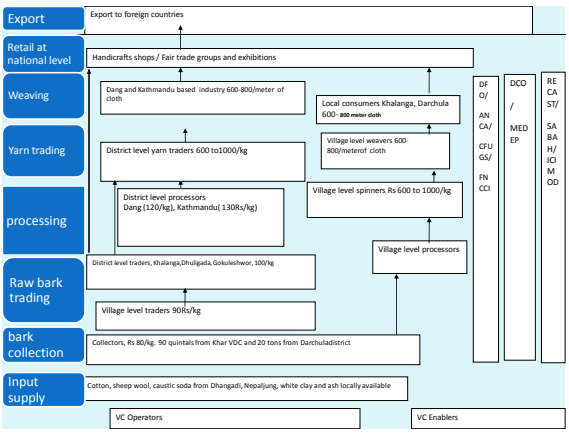
- Collection, binding, cooking, spinning
- The traditional spinning machine (*Charkha*)
- Hand spindle (*Katuwa*),
- Wooden hammer (*Mungro*) is still in practice.
- White clay soil (*Kamero)* for softening.

- Traditional use of ash and soil in kg for the processing of allo.
- Response of local community on availability of allo in natural habitat









- Women are mostly involve in allo processing, spinning, knitting and weaving
- The income generated from allo is used to buy daily requirements and also used for saving in cooperative.
- Allo gave us income generating opportunity in society. *Kopila Kulung, Khadbari*
- Women use generated money to buy daily cooking requirements and also for their children.

- "Allo has changed the perspectives of women in Khar, Darchula district; they have begun to think beyond their kitchen and their livestock sheds"-*Govinda Singh Thagunna Godhani* (KAILASH)
- Allo also helped disaster effected people to sustain their life on critical situation.

Rubia manjith, Red dye

Traditional natural dyes are produced from *Rubia manjith* utilizing the locally available plants with special rituals.

Cultural use of Allo

- At pregnancy time – to prevent from evil spirit burning of fibre of allo.
- At marriage ceremony
- Nagi puja: During Nagi puja 62 to 80 pairs of cloth piece is needed.
- Funeral: to show road by 3 people. To cover the dead body . Removal of allo cloth after the funeral ceremony

Community involved in sustainable management

- Forming rules and regulation within the members.
- Particular month and date for harvesting of allo from forest.
- Collection rules and sharing of collected allo among the members.
- Involvement of members in cultivation activities.

Sustainable harvesting practiced by community

- Community understand the proper harvest which ensures the sustainable management of Allo
- It is better to harvest in October to December after the maturation of seeds.
- Highly branched allo, leave for seed production.
- Leave 4 inch above the ground
- Members from CFUGS, VDCs and concern organization followed the collection rules.

Way forward

- Recognition and sustainable use of ILK with respect to ILK holders is an important need and concern in allo.
- Need of sustainable management practice through cultivation and plantation.
- Clear policy for marketing of finished products traditionally produced from NTFPs including allo.
- Use of modern techniques and machines in spinning and weaving methods.


THANK YOU

Indigenous and Local Knowledge (ILK) on Mushrooms, Lichens and Caterpillar Fungus (Yarsagumba) in Nepal Himalayas

Shiva Devkota
PhD Scholar
Swiss Federal Institute for Forests Snow and Landscape Research WSL
Zurich, Switzerland



Executed Programs

2004: Building Capacity to protect Biodiversity and Indigenous Rights through Documentation and Registration of Traditional Knowledge in Nepal **(IUCN Nepal)**	**Biodiversity (Plants & Animals)**
2005: Community Forestry and Integrating Biodiversity of Nepal **(ComForm Project, Institute of Forestry, Pokhara, KVL Denmark : DANIDA)**	**Mushrooms**
2006-07: Ethnoecology, Regeneration Pattern, Collection Techniques and Trade of Yarsagumba (*Ophiocordyceps sinensis*): In Dolpa Region of Nepal **(SAFE Concern Kathmandu, Cirrus Consultant : WWF Nepal, NARDF)**	**Caterpillar Fungus (*Ophiocordyceps sinensis*)**
2011-014: Biodiversity and Livelihood Development in Land-use Gradients in an Era of Climate Change **(WSL Switzerland, Central Dept. of Botany, Tribhuvan University : Swiss National Science Foundation)**	**Lichens & Mushrooms**

Mushrooms
(Macromycetes)

Mushrooms of Nepal

Explored areas
Mostly Central and Eastern Nepal

Total species:	1400 (Approx.)
Edible	228
Medicinal	19
Poisonous	66

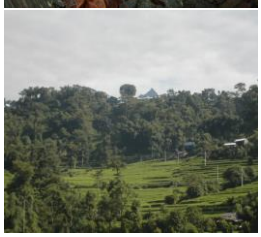
Mushrooms lovers:
Tamangs, Magars, Thakalis, Newars, Sherpas, Chepangs

Lactarius thakalorum
(Thakalis of Mustang)

Amanita chepangiana
(Chepangs of Chitawan)







Termitomyces clypeatus
Highly used mushrooms in Mid-hills of Nepal




Collection and Use of Wild Edible Fungi in Nepal[1]

Morten Christensen,[2,*] Sanjeeb Bhattarai,[3] Shiva Devkota[4] and Helle O. Larsen[2]

Economic Botany, 62(1), 2008, pp. 12–23

Habitat

Eco-region[a]	No. of species[b]
Dry Sub-alpine forest (3000–4000 meters—m): *Juniperus* spp., *Pinus wallichiana, Betula utilis*	39
Temperate Coniferous forest (2500–3000 m): *Pinus wallichiana, Tsuga dumosa, Abies* spp.	66
Temperate Broadleaved forest (2000–2500 m): *Quercus* spp., *Alnus nepalensis*	54
Subtropical Coniferous forest (1000–2000 m): *Pinus roxburghii*	56
Subtropical Broadleaved forest (1000–2000 m): *Schima wallichii, Castanopsis* spp.	54
Tropical Broadleaved forest (100–1000 m): *Shorea robusta, Bombax ceiba*	37

Ethnic Groups

Ethnic group	No. of species
Tamang	56
Magar	51
Gurung	47
Dalit	34
Chhetri	31
Bhotia	29
Brahmin	27
Thakali	26
Sherpa	23
Newar	22

Species with market value

Species
Laccaria spp.
Cantharellus cibarius
Lactarius thakalorum
Russula delica
Tricholoma terreum
Morchella conica
Lateriporus sulphureus
Ramaria spp.
Termitomyces heimii
Grifola frondosa

Edible Vs Poisonous mushrooms

General belief	Status	Edible species	Poisonous Species
All mushrooms growing on **live trees** are edible.	False	*Pleurotus sp.* *Lentinus sp.* *Laetiporus sp.*	*Clitocybe olearia.*
All the mushrooms growing on **decaying straw** or manure are poisonous.	False	*Coprinus comatus*	*Stropharia sp.* *Psilocybe sp.* *Coprinus disseminatus*
All **soil inhabiting species** are deadly poisonous	False	*Morchella conica,* *Russula delica,*	*Amanita muscaria* *phalloides*
Bright coloured mushrooms are poisonous	False	*Amanita caesarea,* *Cantharellus cibarius* *Tricholoma nuduns*	*Amanita pantherina,* *A. muscaria,* *Russula emetica,*
Mushrooms with **rough warty cap** and texture are poisonous	False	*Amanita rubescens,* *Microlepiota procera*	*Pholiota adipose* *Amanita cokeri*
Mushrooms **whose flesh changes after touching** and brushing are said to be poisonous	False	*Boletus cyanescens*	*Boletus luridus*

Edible Vs Poisonous mushrooms

Mushrooms **bearing vulva** are poisonous.
Mushrooms **bearing annulus** (ring) is poisonous
Mushrooms which cause milk or **egg to coagulate** are said to be poisonous
Mushrooms that produce **latex** on being injured are said to be poisonous
Mushrooms with **bitter, acrid** or pungent taste are poisonous
Poisonous mushrooms can be **detoxified** after boiled in water with or without salt or vinegar
All mushrooms loose their poison through **exsiccations**
Poisonous mushrooms **tarnish a silver spoon**, onion, and garlic pieces.
Mushrooms that are consumed by **flies, squirrels,** cats, monkeys are edible to humans.

<u>To minimize poisoning</u>

- Avoid unknown species
- Boil mushrooms in mild salt water, turmeric Powder before cooking
- Do not store long time in Plastic bags/containers
- Do not eat large amount in first time
- Add vinegars while cooking

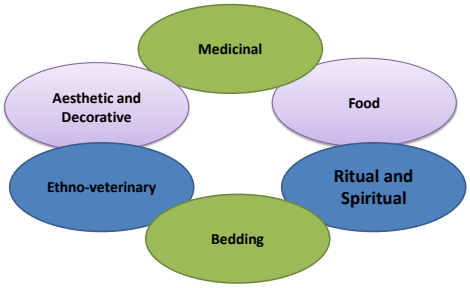
<u>Treatments</u>

Vomiting / Vinegars / Mild black tea / Doctors *Paris poryphylla* (Satuwa), *Xanthoxylum armatum* (Aakhen Timur), Allium sativum (Lasun)

Lichens

Uses : From Kitchen to the Space

Lichen is much preferred as food and for rituals by Limbu, Rai and Tamang indigeneous peoples of Eastern Nepal.



Parmotrema and *Everniastrum, species in mixed*

- ✓ Boil lichen in ash solution for 1-2 hours.
- ✓ Wash with cold water, sun-dry on bamboo mat-*mandro*. Pack and store in plastic bags.
- ✓ The dried lichen is re-hydrated before cooking and or making mixed curry.
- ✓ Mix with pork-buffalo-sheep blood. Fill up their intestine and deep fried in butter or oil to make sausage.

A typical Limbu house)

Limbu Woman

Usnea longissima

Cleaning of religious cups – *Butter Lamps*

Ritual and Spiritual

Thamnolia vermicularis

Ward off evil spirit

Usnea longissima - *As bedding cushion by herders and caterpillar fungus collectors*

Caterpillar Fungus # Yarsagumba
(*Ophiocordyceps sinensis*)

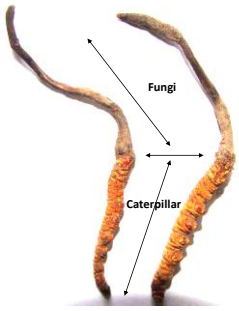
Yarsagumba (Caterpillar fungus)

Ophiocordyceps sinensis (Berk.) G.H. Sung, J.M. Sung, Hywel-Jones & Spatafora

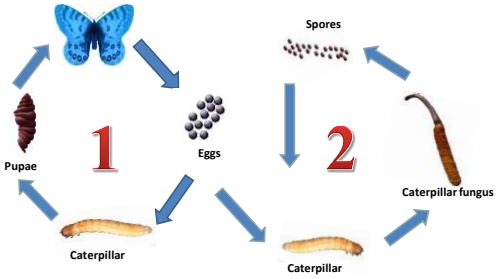
Distribution in Nepal : 3540 – 5050 m

Nepali:
Yarchagunbu / Yarsagumna
Kira - Insect
Buti - Tonic
Jeevanbuti - Life tonic
Chyau - Mushrooms
Chyau kira - Mushrooms insect
Jara - Root

21 species, 6 genera and 3 families of Cordycepioid fungi are reported so far from Nepal



Life Cycle of Caterpillar Fungus



Distribution

China, Nepal, Bhutan, India

Collectors

Collectors on the way to pastures:
They were on the 4th day of their trip and have to walk still three more days to reach collection pastures

Well equipped collector resting

Human Flow in the pastures

Highlands Camp (4000m)

Post Harvesting – In the same evening of collection

Brushing to remove soil and outer thin membrane of the caterpillar

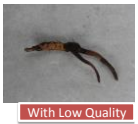
Taking care of broken pieces

Stored in the cotton cloth with proper aeration

Quality Indicators

Golden color

More the weight with tight compactness



With Low Quality

Strong earthy smell

Taste like liver

Longer caterpillar and smaller fungal part

Clear inner white part in breaking

Uses : Past to Present

Our Nature (2006):44-52

Yarsagumba [*Cordyceps sinensis* (Berk.) Sacc.]: Traditional Utilization in Dolpa District, Western Nepal

S. Devkota

First mentioned by Nymji Dorji, a Tibetan Physician (1439-1475)

Western Research:

- Anti cancer
- Anti viral
- Reduction of cholesteral
- Increase of stamina

In Nepal prescribed for:

Tonic	Sexual stimulant
Diarrhea	Headache
Cough	Rheumatism

In this world sexual desire is,
The most marvelous of all earthly pleasures
The essense of the enjoyment of all the senses...

As to this medicinal substances:
It grows in regions of beautiful mountains
Such as remote grassland mountanins.....

It has similar warming qualities
It is flawless treasure of an ocean of good qualities
.....
"A Ocean of Aphrodisiacal Qualities "
By Nymji Dorji (1439-1475)

Mode of Preparation

- Take dried OS (1 Piece) + Half ltr cow`s milk + 2 teaspoon butter and boil for 2 minutes. Take this composition daily at least for a week.
- OS + Alcohol after 6 months
- Prepared with varieties of meat

Marketing as Himalayan Viagra and as the Tonic Agent with booming price (Price more than 20,000 USD / Kg in Kathmandu)

The Way Forward

Domestication /
Value Chain /
Conservation and Sustainable Use of Biodiversity
IPBES Mission: LONG TERM HUMAN WELL-BEING

Resource Estimation and Management Guidelines

Access the State of Biodiversity and of the Ecosystem Services / ILK Documentation

IPBES Operating Principle:

Take an interdisciplinary and multidisciplinary approach that incorporates all relevant disciplines, including social and natural sciences

Acknowledgements

Dr. Morten Christensen, KVL, Denmark
Late Dr. Damodar Parajuli, Secretary, MoFSC/GoN
Prof. Dr. Christoph Scheidegger, WSL, Switzerland
Prof. Dr. Krishna Kumar Shrestha, Tribhuvan Univeristy
Prof. Dr. Ram Prasad Chaudhary, Tribhuvan University

The Royal Veterinary and Agricultural University of Denmark (KVL)

CENTRAL DEPARTMENT OF BOTANY

Nepal Agricultural Research Development Fund (NARDF)

....supporting organizations and field staffs

Thank You !!

shiva.devkota@gmail.com

Qanat, traditional irrigation system in Iran

Saeid Nouri Neshat,
Nina Aminzadeh,
and Mehdi Almasi

IPBES South and West Asia Sub-Regional Dialogue Workshop

Boompajuhan Society
November 2016

Background

- a one day workshop was held on 18 September 2016 in Kerman City
- The participants:
  - a number of *muqannis* (Qanat diggers) from several townships of two provinces of Kerman and Yazd (from *Zarch Qanat* – the longest Qanat in the world, registered on the UNESCO World Heritage list; one person with a long experience in repair and restoration of Qanats in many provinces including Yazd, Kerman, Hormozgan; and one from *Hassan Abad* in Mehriz – Yazd province: one of the UNESCO registered Qanats)
  - women members of Gozhino local group (living in Shafiee Abad village, in Takab district within the boundaries of Shahdad in Kerman)
  - Non-governmental organizations from Tehran, Kerman, Yazd and Shiraz
  - Governmental bodies (the Organization of Cultural Heritage, Handicrafts and Tourism, the deputy of Water and Soil Department of the Ministry of the Agricultural Jihad,
  - Researchers on Qanat (from Kerman university)
  - Local farmers who are users of the Qanat water

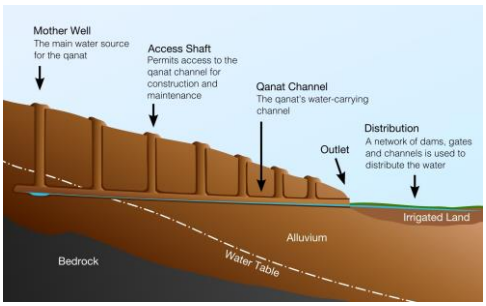
The five important issues

- **A. Qanat and ecosystems**
- **B. Qanat and the livelihoods**
- **C. Qanat Management**
- **D. Qanat and women's participation**
- **E. The Qanat system and policy-making**

What is Qanat?

- 'Qanat' as "an underground gallery that conveys water from an aquifer or a water source to less elevated fields. In practice, a Qanat consists of a series of vertical shafts in sloping ground, interconnected at the bottom by a tunnel with a gradient more gentle than that of the ground. The first shaft (mother well) is sunk, usually into an alluvial fan, to a level below the groundwater table. Shafts are sunk at intervals of 20 to 200 meters in a line between the groundwater recharge zone and the irrigated land. From the air, a Qanat system looks like a line of anthills leading from the foothills across the desert to the greenery of an irrigated settlement."

As defined by the international Center on Qanats and Historic Hydraulic Structures under the auspices of UNESCO



More about Qanāt

قنات

- They create a reliable supply of water for human settlements and irrigation in hot, arid and semi-arid climates.
- The qanat technology is known to have been developed by the Persian people sometime in the early 1st millennium BC and spread from there slowly west and eastward.
- The value of a qanat: the quality, volume and regularity of the water flow.
- Expensive to construct: it has a long-term value to the community.

UNESCO has recognized Qanats in Iran

- The UNESCO World Heritage Committee, in its 40th meeting in Turkey, inscribed eleven qanats in Iran on the World Heritage List that have been documented dating back from 2500 to 200 years old for reasons such as unique technologies used in digging qanats, and unique features like the oldest or the longest.

- Gonabad and Baladeh in Ferdos
- Hassanabad in Mehriz
- Zarch in Yazd
- Ebrahimabad in Arak
- Mazabad in Meimeh
- Vazvan in Meimeh
- Two-floor Qanat of Ardestan, Joybar, Akbarabad, Ghassemabad Baravat in Kerman.

A. Qanat and ecosystems

- The Qanat irrigation system is an old achievement of human engineering and can be considered as an environment-friendly technique with no damage in the nature and a suitable way for the conservation of water resources.
- The speed of water in Qanat water ways is the same as in the nature; it runs by gravity and does not disturb the natural water balance.
- The process of building a Qanat inflicts no damage in the nature through using eco-friendly materials and using local knowledge with the least possible use of modern technology (2).
- There are some cases where the Qanat irrigation system provides water for the wildlife and vegetation coverage. An example: The *Qomishloo* wildlife reserve and national park in Isfahan province is one of these cases where the sustainability of the wildlife (37 species of mammals, 82 species of birds, and 32 species of reptiles) depends directly to water from its qanat (3).

Challenges

- Digging deep wells: Level of underground water is decreasing in desert areas in Iran.
- While the government tries to define measures to conserve the subterranean water, people continue to dig deep wells illegally (using new modern technology).
- The Qanat system can be a sustainable way for using underground water.
- Projects have to be defined on participatory management of underground water (water is more important than Qanats)
  - Agriculture efficiency
  - Water pricing
  - Working together in different communities using one underground water reservoir.

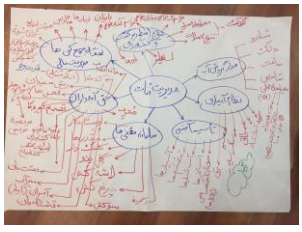
B. Qanat and the livelihoods

- The Qanat irrigation system has direct impact on the lives of people who use the water for agricultural use. The Qanat owners have a duty to pay for maintaining Qanat (which is called *Nafagheh*) in proportion to their ownership and their share of water.
- Qanat water users are involved in protection of Qanats too. This can be easily understood by the ceremonies and the rituals that are held in connection with Qanats: intangible heritage
- In the past, the amount of harvested water was sufficient since that the number of owners were less. Today, due to the inheritance through generations, the number of owners have increased, and the amount of water per user has decreased. In the past, there have been less deep wells, and thus the level of the underground water was higher, and thus Qanats had significant impact on agriculture. People were more involved in protection of their Qanats since they had more income due to water resources from Qanats.

Challenges

- Timely payment of *Nafagheh necessary for sustainability of Qanats: T*he water flow cannot be stopped for the one who has not paid Other problems regarding the Qanat irrigation system are as follow:
- Laws regarding digging wells
- Drought
- Non-observance of the distance of a deep well from a Qanat which has to be 3000 meters according to the regulations
- Selling deep wells of the big owners through bids with an excuse to provide drinking water
- High costs of dredging especially because mechanical machines are used
- Problems in selling the agricultural products such as pistachio and dates, mostly because those who buy the products do not pay in time.

C. Qanat Management



Mindmap worked out in the workshop in Kerman on 18 September 2016; it addresses most of the management aspects of Qanats in Iran

Irrigation system and division of water

- The time measurement in division of water among users is called "*madar*" (orbit) that can change based on the existing capacity of the qanat to provide water and the number of owners and it can last eight to fifteen days.
- This time does not change in the two existing models of traditional management (*taghi* and *mirabi*). Any disturbance of the "*madar*" without the agreement of all owners of a qanat is considered a crime, except in emergency or for special purposes.
- Local measurement methods are: *shabaneh ruz* (day and night), "dang" (share); hour; indicator; sunset or sunrise; and stars.
- In *taghi* (*taqi*) system, there is no need to farming calendar, since the water division and turns do not change. The water share of any person is appropriate to the land the person has.
- In *Mirabi* system, due to the increased number of shareholders and the existing imbalance between water and land (separation of water ownership from the land ownership).
- Of course, for strict supervision, first, they divide the year into farming seasons, and the water supply in each season is specified. This division can change based on the time and place and has a direct relationship with climate conditions in each area.
- The irrigation and distribution of water occurs using traditional methods, and *sabu* (seven minutes and a half to twelve minutes), *jurreh*, *sang-e sayeh*, *taaq* (twleve hours), and *tashteh (a copper bowl with a hole in the bottom)*.
- The position of *Mirabi* in rural communities is of a special status and is often hereditary (from father to son).
- In fact, *Mirab* is the divider of the water. It is worth mentioning that in April 2014 that the Food and Agriculture Organization of the United Nations officially registered the Qanat Irrigated Agricultural Heritage System of Kashan, Isfahan Province, as a Globally Important Agricultural Heritage System (GIAHS)

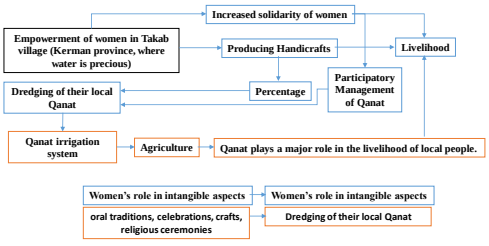
Challenges to Efficient and Participatory Qanat Management

- "Qanat" is a local knowledge that relies upon its management system. Without this system, maintaining, repair, restoration or dredging of a Qanat is not possible.
  - The number of owners (inheritance can affect it)
  - The farmers and the farms (payments, what they cultivate)
  - The extent of the Qanat (how big it is)
- Participation of all owners and users are needed, especially in payment of *Nafagheh* to maintain the Qanat alive.

D. Qanat and women's participation

- "Qanat irrigation system" is effective on women's life.
- A case: The local women's groups in the villages of Takab (Kerman province) have decided to dedicate a percentage of the sale of their handicrafts for repairing their Qanat.
- Men have a more highlighted role, especially considering the fact that men do most of hand work. However, women might participate in financial issues, and they can enter in decision-making regarding Qanats.
- The Qanat irrigation system is a combination of tangible heritage (such as architectural form) and intangible (such as oral traditions, celebrations, crafts, religious ceremonies and local games). Women have highlighted role in intangible aspects.

D. Qanat and women's participation



E. The Qanat system and policy-making

Three governmental bodies are directly related to the Qanat irrigation system:

Regional Water Organization
Agricultural Department (Agricultural Jihad)
The Organization of Cultural Heritage

Two other governmental bodies (not much related):
Department of Environment
Department of Endowments and Charity Affairs

	Regional Water Organization	Agricultural Department (Agricultural Jihad)	The Organization of Cultural Heritage
Why?	Qanat is a system of provision and distribution of water	Qanat provides water for agriculture	Qanat is a cultural heritage
Functions	This organization issues permission for maintenance of Qanats, and plays a major role in certain fields such as flood control, determining the limits of Qanats as well as certain other data collection activities.	This organization is responsible or organizes or facilitates certain activities related to Qanats such as dredging, reconstruction, or reviving, and also it is responsible for organizing *muqannis*	This organization is in charge of registration of Qanat as national or global heritage. Other issues: determining the limits of a Qanat (by the time the limits are important as a heritage-related issue).

Department of Environment	Department of Endowments and Charity Affairs
Qanat in certain protected areas is the water resource for the plants and the wildlife	Water in certain qanats are Vaghf for Emamzadeh or for charity activities
Nothing defined in the laws or regulations	Repair and restoration of the endowed Qanats

Challenges in policy-making

- No major policy on conservation of Qanats
- Contradictory policies (strengthening of well-diging, new technologies that destroy Qanats, big dams)
- Certain important Qanats have been conserve
- Non-recognition of the traditional and local management system

- Inheritance issues
- Vaghf issues

Local knowledge of Nomads in Sustainable Management of Pastures in TangeSayad –Sabzkouh Biosphere Reserve

By: Bahar Mohammadifar and Mortaza Ashrafi
(Tanks to Mohammad Soltanolkotabi and sead Nori Neshat)
Behtash Pardaz Behrooz CO
Photos By: Mohammad Reza Momeni & Hasan Moghimi

Contents

Photo By: Mohammad Reza Momeni

Background

Iranian nomadic society has a long history and culture.

Part of the nomadic population live in the Zagros forests

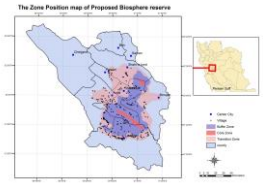
Despite the many poor people in rural and tribal communities, they continue to be the holder of natural resources and play an important and crucial role in the stability of ecosystem of Zagros area

They have been considered the country's largest livestock producers

Photo By: Hasan Moghimi

TangeSayad –Sabzkouh Biosphere Reserve

- Tangsayad - Sabzkouh Biosphere Reserve With an area of 532 thousand hectares, Tangsayad - Sabzkouh Biosphere Reserves cover more than a third of Chaharmahal and Bakhtiari and its major mountain pastures are in the range of Bakhtiari nomads summering areas.



Bakhtiari Tribe

Natural and climatic factors in Zagros forest range, have created specific conditions for the biodiversity from the southwest to North West of Iran.

Zagros forest ecosystem has been winter and summer sites for nomadic herders, here in this research, Bakhtiari tribes.

Photo By: Hasan Moghimi

B. Components of Local Knowledge in Grazing and the Management of Pastures among Nomads

B.1. Kinds of pastures in local knowledge of Nomads

- **Grazing**: Khordeh (grazed), Nakhordeh (not grazed)
- **Slope**: Southern slopes; Northern slopes
- **Livestock**: Hezareh (thousand herding units), Nim-hezareh (500 herding units), Charak (250 herding units)
- **Season of grazing**: Bahareh (spring); Paeezeh (autumn), Zemestaneh (winter)
- **System of grazing**: closed, open

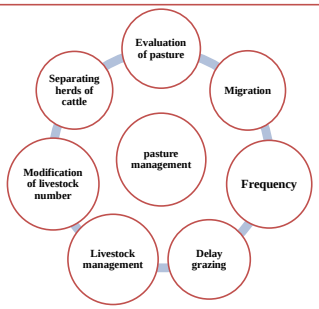
B.2: Indigenous mechanisms for livestock and pasture management

Pasture management:

Techniques of this strategy involves migrating, to evaluate pastures, pasture segmentation, frequency, delay grazing, pasture and grazing lease that are obtained through using focus groups.

Photo By: Mohammad Reza Momeni

Indigenous mechanisms for livestock and pasture management



1. Migration

Height difference and different climatic conditions resulting from are the features of ecosystems of Iranian tribes that has turned territory of the tribes into a land of different climates. On the one hand, suitable condition and on the other hand ecological necessities has led the tribe to select dry lands and match to the conditions in order to utilize the resources.

2. Evaluation of pasture

Migration is done after examining the water, fodder, cold and heat, winter and summer pastures which first in groups they go and examine the region in terms of water, fodder and etc.

3. Frequency

A clear example of frequency is migration which is done in large-scale in the winter and summer of geographical scope, but also smaller frequency range is observed, for example, in a winter, nomads in the region in the early days, the pastures used for feeding the livestock raised downstream and then upstream pastures and foot range the growth of their plants occur late. These "eaten" parts are protected and are used for night grazing or other purposes.

4. Delay grazing

If the rainfall in timely, the first heavy rain of autumn that lasts at least 3-2 days, which continues and the deep infiltration of water leads to germination and growth; because the weather is warm and this precipitation helps the plants grow to 2 or 3 leaves stages and after one week, rain can accelerate the growth. If it happens, nomad wait for the plants to get ready for gazing to let cows, which needs taller plants comparing sheep, graze. In this conditions, the height of the plant is 10 cm. Thus if the interval between rains gets longer, they use delay grazing techniques that is feeding the cattle manually and wait for the plants to grow.

6. Protection

Herders by signs such as Scarecrow and or picking up a few rocks, specify the range in which grazing is not possible.

No one has the right of grazing in this area and if grazing happens, it leads to conflicts between people.

The aim of protection is preventing the herd from early entrance to pasture when plants are blossoming.

Because if grazing happen, no seeds will remain for next yea in the pasture.

Photo By: Mohammad Reza Momeni

Protection

- Nomads' migration has had a fundamental role in grazing management on summer and winter grasslands and the feed in the pastures continue to be maintained at a high level as long as nomadic livestock was removed from summer or winter, these grassland could have a break and even if the possibility of rape of rural dairy farmers were given to pasture in the absence of nomads, the nomads were protected by installing guards from their pastures.

Photo By: Mohammad Reza Momeni

7. Livestock management

This method includes herd diversity, separating livestock and modification of livestock numbers which is the result of focus groups implementation.

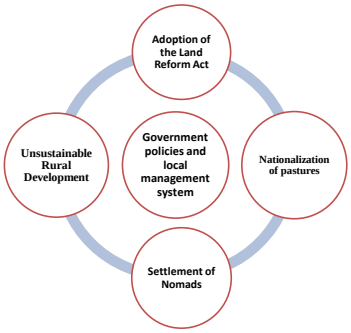
Photo By: Hasan Moghimi

8. Separating herds of cattle

In order to make optimal use of pasture and tailored to the needs of cattle herds are separated, meaning that in winter the dry and dairy herds constitute two different herds. Goats are often with dry herds. The herds are generally part of the "eaten" pasture or areas where vegetation is not favorable. Lactating herd with rams that use intact parts of the pasture and when using supplementary feedstuff have better forage.

Photo By: Hasan Moghimi

C: The challenges ahead in the native pasture management practices and the role of government policies in the native pasture management practices



1. The Land Reform Act and the Challenges

During the land reform period, most of the areas used by the nomads became agricultural land and changed into the "rain-fed agricultural land.

The previous Khan system had a control on the number of livestock and with the Land Reform, the Khan system collapses: villages started to increase their livestock.

Photo By: Hasan Moghimi

2. The Law on Nationalization of Pastures

With the Nationalization of the Pastures, the local management system and the local knowledge faded in certain areas.

The Government issued licenses for grazing. Those with influence gained licenses.

Nomads sustained their social life in certain areas, but the governmental system and the related laws weakened them; more poor nomads, and more destruction of pastures

Photo By: Mohammad Reza Momeni

Settlement of Nomads

•Endogenous settlement
•Planned settlement

Photo By: Mohammad Reza Momeni

Nomads Settlement and the Challenges

Limited environment for the Nomads	• Unsustainable rural development • Local knowledge on pasture management to be forgotten
Nomads are becoming poorer	• Selling livestock to build houses • Unemployment among young people
Pastures are being destroyed	• An increase in using wood • Overgrazing

- The authors also observe that when nomads settled, staying time of livestock increases and the effect of early graze and increased time of livestock stay in pasture together with spatial limitation resulted from settlement and decreased radius of daily graze, pasture are increasingly damaging.
- However, statistics show that demand for housing is high among Bakhtiari tribes and this demand and results of research on nomads' settlement show that if the government fails to act on improving and diversifying nomads livelihood and fails to turn strategic plans about pasture shared management and livelihood improvement into operative plans, Iran will face with developing unsustainable tribal and rural settlements and further is facing destruction of pastures and natural resources.

D. Proposed strategies for interaction between pasture management in local and formal styles.

Nomadic pasture management system has faced challenges during its long history due to imposed policies on economic, social and political levels of nomadic society. Investigating factors effective in creation of such challenges against this traditional system and analyzing solutions and strategies can lead to sustainable management of pastures in pasture exploitation system.

Photo By: Hasan Moghimi

D.1 Proposed strategies for interaction between pasture management in local and formal styles.

Finding solutions through holding dialogue among Nomads and the local authorities on existing challenges

D.2:To protect the pastures in Spring, local groups of protectors are needed

2. Programmes for settlement of Nomads have to be reviewed with an environment-friendly approach

Photo By: Mohammad Reza Momeni

3. Cooperatives can be useful for selling the handicrafts of nomads' women

Photo By: Hasan Moghimi

4. Collecting and Registration of Local Knowledge of Nomads
(the knowledge is now in the mind of old people, and the old people are not much interested in new technologies) **Photo By: Mohammad Reza Momeni**

5. Supporting young people and women through vocational training

6. Creating Local funds for supporting women's livelihood activities among Nomads and in rural areas

Photo By: Mohammad Reza Momeni

Other Solutions

- ✓ 8. Motivation and financial support for maintaining heavy livestock instead of light livestock (using modern technology) in settlement of nomads.
- ✓ 9. Encouraging local management of pasture (based on local knowledge) though creating balance between the number of livestock and the capacity of pastures (observing the local rules – especially the seasons)
- ✓ 10. Encouraging the government to adopt measures for inclusion of students from nomads in the formal education system
- ✓ 11. Review of national law and regulations of forest and pasture, land transfer regulations
- ✓ 12. Employment in crafts for tribal women and help improve livelihoods
- ✓ 13. Rehabilitation and correction poor and destroyed pastures with the support and partnership management of nomads and villagers.
- ✓ 14. Support packages to help nomads for grazing
- ✓ 15. Traditional tribal councils to fill the gap in the system of nomad administrative and managerial.
- ✓ 16. To update the country's natural resources laws to solve problems created by conflicting laws

References

- Badjian.Gh.(2008). Nomadic Rangeland Management in past and present in a review: Changes, Challenges and Solutions. Iranian journal of Range and Desert Reseach, Vol. 14 No. (4), 2008.
- Esmailniya.hoseyn. Sheykhali.mortaza (2013), nomadic community development bottlenecks and solutions in Iran, Journal of Agricultural and Natural Resources.
- Papzan, A.H .Afshazadeh,N.(2010). Native mechanisms in range management of Kalhor tribe's nomads.Iranian journal of Range and Desert Reseach, Vol. 17 No. (3), 2010
- Ziya Tavan, M.H,Tavakoli,J. Accomodation of nomades and destruction of pasture in Charmahal and Bakhtiari province.Journal of Rural Development, No. (2), Summer 2008
- Amir Ahmadiyan,B. Traditional, administrative and management structure of Bakhtiari tribe and its functions.National Studies, No.3.2004

Thank you very much

Mukkuva Community of South India.

Robert Panipilla
Friends of Marine Life (FML)

Main Themes	Source of information	Tools / methods to be used
History and Cultural background Traditional Marine Fishery Knowledge and practices. Role of Modern Technology Impact of Regulations and outsiders Encroachment in Mukkuva's fishing rights knowledge and practices. Changing nature of ILK and practices. Challenges in preserving mukkuva's ILK and practices.	•ILK Experts from the Mukkuva Community. •ILK Holders from Mukkuva Community and others. •Chelaalikal (Expert fishermen). • Sangam Literature. •Marine Fisheries Census 2010 Kerala By CMFRI.	• Expert Presentations. • Group discussions. • Focus Group discussion. • Interviews.

History and Cultural background

Demographic Socio –Economics characteristics.

Population density in kerala per Sq/km – 823. In coastal area – 2176 sq /km

- 590 KM coastline.
- 9 coastal districts.
- There are 222 marine fishing villages.
- 1,20,486 fishermen households.
- 6,02,234 marine fishermen population.

Coastal Districts in Kerala

Population distribution structure and Total households in Trivandrum district

Population details	
Male Adult	52,548
Male child Above 5 yrs	16424
Male child upto 5 yrs	6230
Female Adult	48904
Female child Above 5 yrs	15683
Female child upto 5 yrs	6537
Total	146326
Average family size	4.39

Community wise details	
Araya community (Hindu)	608
Maraykar community (Muslim)	4788
Mukkuva community (Christian)	27,944
Total households	33,340

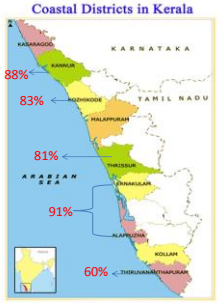
Total Population, House hold and Active Fisher folk in Trivandrum district.

Total Population	1,46,326
Total Households	33,340
Total Active Fishermen	34,322
Total Active fish vending Women	11,922

Educational status of Trivandrum fisher folk

Education Status in Trivandrum	
Male Primary	19098
Female primary	18331
Male H.S	18191
Female H.S	16674
Male above H.S	4560
Female above H.S	4156

Educational Status in important Coastal Districts in Kerala



Educational Status of Kerala – 94%

Community wise distribution of Marine fishermen families Kerala		
Community	in Kerala	in Tvpm
Araya	31%	0.50%
Maraykan	27%	14%
Mukkuva	42%	85%
SC/ST	1.50%	0.50%

Socio-Religious History

- We only know the five centuries history of Mukkuva Community since European invasion and hence it is Catholic Church history
- Colonialists neglected the Socio-Cultural and Linguistic identity.
- Only source of information so far available is about coastal communities are in the Sangam literature (which is considered to be written the 1st Century AD).
- There is also confusion and different interpretations of the origin and the terminology of Mukkuva.
- Today's Mukkuva communities are spread around Kerala, Tamilnadu, Andhra Pradesh and Sri Lanka.

Bio-cultural Diversity

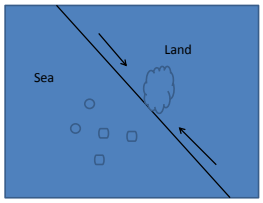
- Limited knowledge is available about bio-cultural diversity of Mukkuva community.
- The history and socio-cultural traditions and livelihood are closely connected with the Marine ecosystem services.
- There is a strong evidence for an inseparable connection between the Mukkuva community and marine ecosystem services.
- Ocean and marine environment has become an integral part of the history and upbringing of the community.

Linguistic Diversity and importance of the language

•The coastal language is also evolved through this interconnection.
•Coastal language/the community language contains many aspects of marine ecology, especially seabed ecosystems.
•However, the language has not taken enough attention, because Malayalam (the regional language of Kerala) is considered to be the official language.
•Over the years, the language has lost many speakers, and ecological knowledge as well.

Traditional marine fishery knowledge and practices

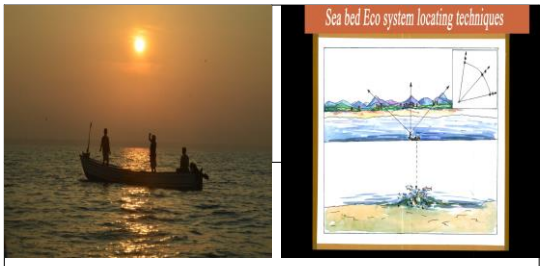
- It is found where there are presence of reef ecosystems in the seabed, the associated coastal areas have developed as the most important places of fishing activities.
- Based on this, we can propose that there is a strong link between geo-physical morphology of the seabed and the socio-cultural history of the Mukkuva community.
- There are some stories says that Innovation of natural reefs caused for migrating people from different places to the nearby village reef area.



Five types of geo-physical features:

Mada - Sandy Seabed. **Most of the seabed areas of Trivandrum are Sandy – not many biological growth.**	
Challipparu – Semi Platform reef. ***Only a few areas of the seabed ecosystems.***	
Tharapparu – Platform reefs. ***Very strong and wider rocky platforms.***	
Paaaru – Rocky reefs. ***Seabed with a huge rocks.***	
Kappalpaaru – Shipwreck reef. ***Sunken areas have become an marine ecosystem.***	

Kanicham



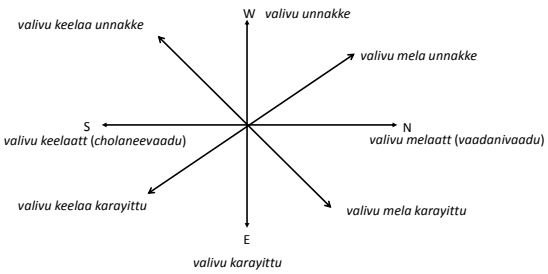
Traditional techniques of locating Sea bed area.

Traditional Crafts & gears in Tvpm district

Kattamaram Fishing

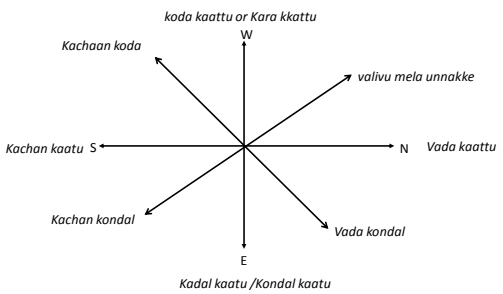
Shore scene Operation.

Ocean currents



Community fishermen knows well about the ocean currents and their seasonal nature, how these influence life patterns in the ocean.

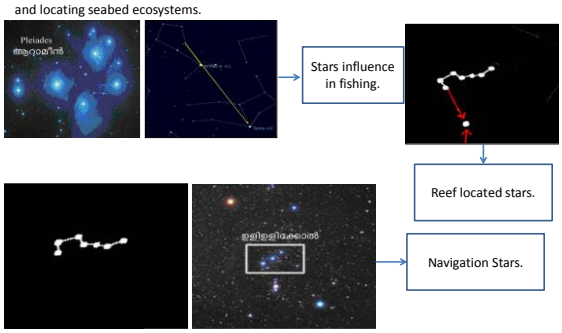
Wind Systems



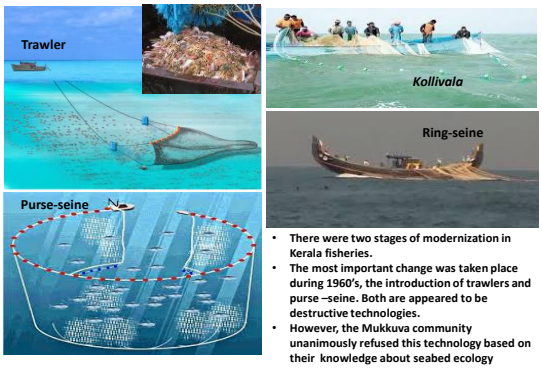
Community fishermen knows well about the wind systems and their seasonal nature, how these influence life patterns in the ocean.

Astronomical

There are many stars and constellations used by fishermen for their livelihood related travel, and locating seabed ecosystems.



Role of modern Technology



- There were two stages of modernization in Kerala fisheries.
- The most important change was taken place during 1960's, the introduction of trawlers and purse –seine. Both are appeared to be destructive technologies.
- However, the Mukkuva community unanimously refused this technology based on their knowledge about seabed ecology

Role of modern Technology

- In 1980's there was the motorization in traditional craft. It was mainly aimed for helping traditional fisher folk to do fishing in deep waters. Their *Kattamarams* replaced into Plywood boats and sail replaced into OBM's.
- The motorization led large investments and the fishermen are found difficulties to manage day to day running expenses.

Impact of Govt regulations and outsiders incrochment in mukkuvar's fishing rights , knowledge and practices.

- Government legislations and polices that promote mechanization causing the destruction of Mukkuva's traditional fishing grounds.
- Most of Govt. projects are mainly focused on mechanization and motorisation which requires large investments. A minority of Mukkuva fishermen are recently started to embracing mechanized vessels.
- A few Mukkuva fishermen are migrated to the harbor areas where mechanized vessels are located.
- Govt's modern development initiatives such as mega transshipment port under construction are causing to lose the Mukkuvar's fishing areas
- The construction of breakwater has already caused the erosion of beaches where the majority of Mukkuvars are located. This creates the situation that become impossible to practise their traditional way of fishing.
- Through the construction of harbors and transshipment terminal, sea water has already featured with the presence of high sediment.
- When the traditional crafts are not able to run from their own villages, the women fish vendors are not able to do their livelihood practices within their villages and they are compelled to go to the harbor area that is leading new socio economic issues.

Changing nature of ILK and Practices

- New generation of Mukkuva fishermen are not able to use'Kanicham techniques.
- They are limited with many traditional knowledge regarding astronomy, wind patterns, ocean currents and even swimming.
- Because of the scarcity of fish resources many traditional fish processing practices are not followed especially by the women fisherfolk.
- Number of fishing days have been reduced due to the modernisation as they fear of loss.

Challenges

- In Kerala's 38,828 sq. km total land area, 10,000 sq. km land has already identified as Eco Sensitive area (ESA) and the respective governments have taken measures to protect this.
- At the same time, no much attention has been given to identify Eco Sensitive Seabed Area in the state's 13,000 sq. km coastal and marine environment.
- However, the community who has the real knowledge about the seabed ecosystems are not consulted or encouraged to participate in any study related to Kerala's marine and coastal environment.
- It is also very important to understand that the marine and coastal ecological knowledge is embedded in the language of Mukkuva.
- There are also indications of Sustainable Development Goal 14: *Conserve and Sustainably use the oceans, seas and marine resources* is practised by the Mukkuva community.
- Ecological perspective of community history is much needed.
- Irregularity of seasons and changing climatic conditions create challenges for their fishing practices.

Implications

- In Kerala marine fish catches are centred around mainly using destructive technologies.
- However, the 42% of the Kerala marine fisher folk, which is Trivandrum Mukkuva community has not yet to use these techniques.
- Language of the Mukkuva community is very important to assess the ecosystem services.

Thank you

Sustainable Resource use and Forest Conservation by the Kaani indigenous community of Kanyakumari forest in the Western Ghats

-S Davidson Sargunam
India

Indian Forests

- -One of the 12 Mega- Bio-diversity centers
- Eastern Himalayas & Western Ghats
- Indian Constitution enshrines environmental protection
- Has Joint Forest Management initiative
- Has many Forest Acts to protect them

Kanyakumari Forests

- In the Western Ghats
- A Hot Spot
- UNESCO Heritage Center
- Has 30.2 % as forests of the total area
- Has 10 dams, many water ways
- 14 types of forests
- Has elephant, tiger, leopard, cobra, king cobra, medicinal herbs, eco-tourism spots
- Give food, fodder, fuel

The Abode of the Indigenous People

Ferrying to the Mountain Forests

A trek to the Huts…

Blood sucking Leech

Kaani Indigenous Community

-Live in consonance with nature in Huts

-Derive everything from Nature

Food culture - tapioca

Priest- Magician-Physician

Animists- Worship Nature

Foot Print -Forest Fire

Forest Fire

Forest Fire

Rubber Plantation

Grazing

Forest Encroachment

Monkey Nuisance

Monkey Menace

Protective measure- threat by Monkeys

Wild Boar

Human X Animal Conflict

Sloth Bear- threat to Honey Culture

Tiger

Sambar

A *Maadam*- A low roof Hut

A safe place at Night

ILK tool- *Adiudukku*

Stone Bow

ILK tool - *Kudukkai*

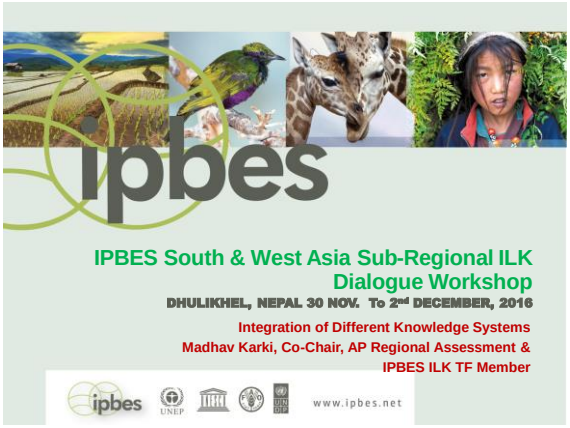
Nanthini…

Innovation to combat Animals

Sustainable Conservation

- Animists
- Never harm animals
- Eco-imbalance of animals
- Imbalance in Predator – Prey Ratio
- Proliferation of wild boar, monkey, sambar
- Animals raids in residential areas
- Results in Conflict
- ILK Tools to counter animals

THANK YOU



Characteristics of ITK

- ITK is local knowledge
- Undocumented but implicit knowledge
- Transmitted from peer-to-peer
- Experiential and practical knowledge
- Tested and tried for generations
- Dynamic and transformative
- Associated with climate sensitive sectors

Relevance of IK

- Agriculture
- Animal husbandry and ethnic veterinary medicine
- Use and management of natural resources
- Primary health care (PHC), preventive medicine and psycho-social care
- Saving and lending
- Community development
- Poverty alleviation
- Adaptation to change (climate and global change)

Special features of indigenous and local knowledge and practices (ILKP)

- Local and embedded in culture
- Tacit (unspoken or implicit) knowledge
- Transmitted orally
- experiential rather than theoretical knowledge
- learned through repetition/practicing
- Constantly changing (dynamic)
- 'Practices' is important to highlight the direct contributions of IPLCs to the stewardship, management of Nature and NBP and its relevance to the larger society.

Key issues in ILKP

- Property rights of indigenous knowledge
- National policies in support of knowledge for development
- role of information and communication technology
- It is highly contextual and therefore often questioned for its validity;

Assessment Methodology

- Multiple methods, approaches and tools
- Socio-ecological systems approach

➢ **Systematic literature review to identify the key issues, gaps, challenges and opportunities**

➢ **Key global and regional processes;**

➢ **Identifying the existing gaps in the knowledge and practices;**

➢ **Use synthesized knowledge by integrating ILK and modern scientific knowledge**

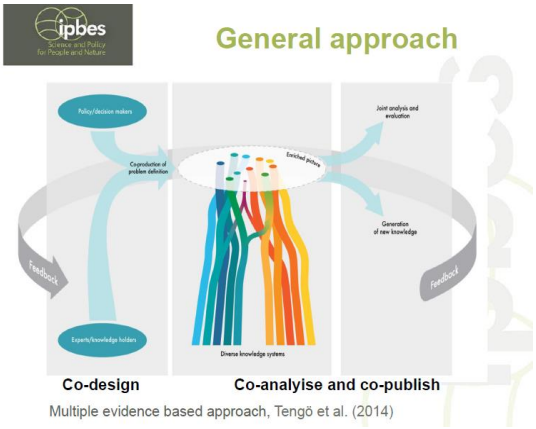
Conceptual basis of integration

- Indigenous knowledge and practices (IK&P) provide good basis for developing adaptation and natural resource management strategies in response to climatic and socio-economic changes;
- IK&P can help design cost-effective, participatory and sustainable adaptation practices since they are based on tested and tried local knowledge.

Principles for working with ILKP in IPBES assessments:

- Bringing ILKP into dialogue with other knowledge systems
- Providing opportunities for dialogue with IPLC's focusing on topics relevant to IPBES
- Allowing time for decision-making through customary and traditional institutions to identify common goals
- Pursuing dynamic and interactive ways for working with ILK and natural and social science communities in the Platform
- Practicing a participatory and inclusive approach
- Enriching the dialogue between knowledge systems as a two-way process, "giving back"

General approach



Multiple evidence based approach, Tengö et al. (2014)

ILK Expertise in IPBES

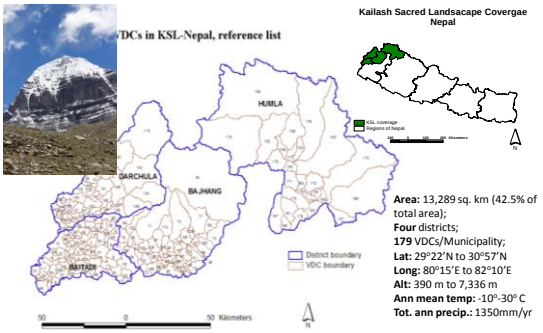
- ILK-holders are people functioning within the collective knowledge systems of IPLC with knowledge from their own community.
- ILK-experts and ILK professional are people from both indigenous peoples and local communities who have knowledge and expertise ILK and associated issues.
- Experts on ILK are people who have knowledge about ILK and other knowledge systems, but are, not from indigenous peoples and local communities
- ILK TF does not have all; so the need for dialogues

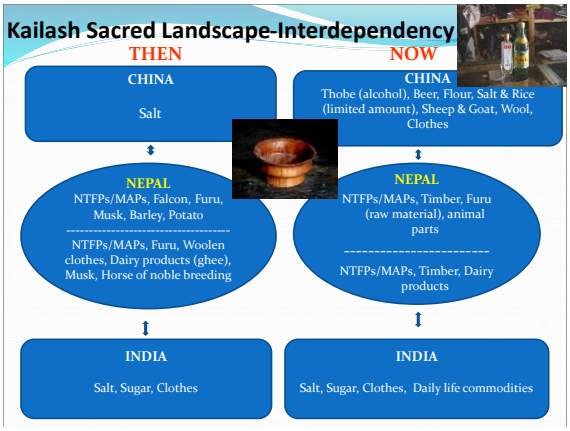
ILK Structures

- Participatory Mechanism for working with ILK: Self-organised network of ILK holders/experts and their organisations for facilitation
- ILK Reference Group: smaller group formed within the Participatory Mechanism to support assessments regarding ILK sources and processes (e.g. white and grey literature, validation, prior informed consent, "giving back")
- ILK Roster of Experts: a database to enhance the identification and mobilization of relevant and qualified experience and expertise in ILK for IPBES


Thank you !
www.ipbes.net

Kailash Sacred Landscape in Nepal





Pasturelands

- Pastoral migration is one of the important livelihood strategies of local people.
- People of the KSL-Nepal, especially in the northern parts, practice transhumance, moving their herds to pastures at different elevations, within their traditiona lterritories.
- NTFP collection
- trade

Objective and Coverage

To bring the story of sustainable management of pasturelands in the northern parts of Nepal – Case study in the KSL-Nepal

- Rotational grazing & Management of pasturelands
- Indigenous institutions and their role in conservation
- Issues and challenges
- Way forward and conclusions

Rotational grazing & Management of pasturelands

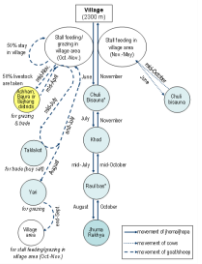
- In Humla, people, especially in the northern parts, practice transhumance
- All the animals are taken to summer season/ pasture, called *Soika* after planting of crops in April/May.
- The pasture for rainy season called *Yarka* are further higher up.
- Usually, around August with the onset of *Tonka* season (autumn) pastoralists start bringing down their animals to lower elevation pasture. The *Tonka* pastures are the same as *Soika* pasture.
- Around the end of the *Tonka* season, crops are also harvested and animals are brought back close to the village when the *Ghunka,* (winter) season begins.

Rotational grazing & Management of pasturelands

- These rotational grazing systems are closely monitored and regulated by the community. If any individual is found grazing animals in Ghunka pasture in other season, he/she is severely punished
- In KSL-Nepal, natural and man-made pasture lands (Kharka or Patan or Bukiyan)
- Broadly classified as Summer (natural rangelands in alpne and subalpine regions) and Winter pastures (forests close to the villages) locally known as *jairini kharka* (the pastures with jungle),

Rotational grazing & Management of pasturelands

Annex 20. Movement of different types of livestock in the Humla district



Rotational grazing & Management of pasturelands

- As a traditional management practice, grasses and other plants are cut annually only once in September-October
- The grasses are dried, stored and used as fodder only during winter months.
- Harvesting restrain is a strategy to get fodder grass available for winter season in fair and equitable way.

Indigenous institutions and their role in conservation

- *Talukdars'* or '*Mukhiyas'* (locally 'gowa') have still been the persons with the main responsibility of local revenue collection.
- In the Limi village of Humla, there has been a traditional system of electing chairperson of the VDC. There are two more types of officials called '*Loiba*' and '*Lora*', which are rotated annually. *'Loiba'* - forest areas; '*Lora'* animals do not stray in the fields. Additionally, calendars for agriculture and transhumance, natural resource harvesting is also set out by these elected persons.
- The monasteries (for example, at Yalbang, Halji, Raling, etc of Humla), apart from assisting people in spiritual aspirations, play a vital role in conservation of wildlife, management of resources, and regulation of socio-cultural practices including agriculture and transhumance.
- *'Lamas'* of 'Tsang-ba' (Community of Dojam village of Thehe VDC, Humla) have been playing an important role in the preservation and management of the natural resources (land, forest, pasture etc.) in Dojam area over the generations.
- The 'Badda' system of Byashis in Darchula district is mainly responsible for running cultural norms, with limited responsibility for regulating natural resources.

Issues and challenges

- **Sheep generally prefer to graze in the pastures rich in *Kobresia* species, *Potentilla* species, *Cotoneaster* species, etc.**
- **In *goth* areas (livestock assembly points) presence of grazing resistant/tolerant species, such as *Athyrium wallichianum*, *Morina nepalensis, M. polyphylla*, *Rumex nepalensis*, etc. clearly show some level of high grazing pressure.**
- **Integrating the traditional management practice with Scientific study**

Way forward and conclusions

- Traditional knowledge generally comprises long-standing traditions and practices of indigenous or local communities; encompasses the skills, wisdom, and knowledge of the communities.
- Living in and from the richness and variety of complex ecosystems, indigenous peoples have an understanding of the properties of biodiversity and ecosystem services and the techniques for using and managing them sustainably.
- Integration of traditional knowledge with modern science for sustainable use of resources is needed.
- Governance of the natural resources and policy need to be developed on both IK and scientific results.

Thank you

"The forest is a peculiar organism of unlimited kindness that makes no demand for its sustenance and extends generously the products of its activity: it affords protection to all beings, offering shade even to axeman who destroys it." – **Gautam Buddha**

Bioprospecting of Plant Resources for Validation of Indigenous Knowledge and Search for Novel Herbal Drugs in Nepal

Krishna K Shrestha[1]*, Yadu N Poudel[1], Krishna D Manandhar[2], Gyandra P Ghimire[2], Sangho Choi[3], and Sabina Shrestha[1]

*Principal Investigator and corresponding author: kkshrestha123@gmail.com

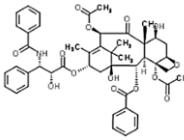
[1]Ethnobotanical Society of Nepal (ESON)
[2]Central Department of Biotechnology, Tribhuvan University
[3]Korea Research Institute of Bioscience & Biotechnology (KRIBB)

"Integration between ILK and Modern Science in IPBES Assessment'

Indigenous and Local Knowledge dialogue for the South and West Asia Sub-region
For IPBES Asia-Pacific Assessment of Biodiversity and Ecosystem Services
(29 November – 2 December, 2016, Dhulikhel, Nepal)

Introduction

morphine
Papaver somniferum
analgesic (narcotic)



Taxol or Paclitaxel
Taxus wallichiana
Anti-mitotic anticancer drug

Hipocrates
Salix babylonica
Bark

salicylic acid
Salix babylonica
Bark

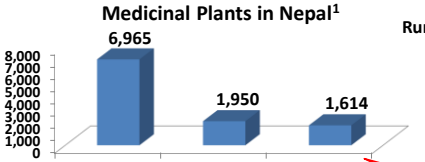
synthetic analog of salicylic acid
1897
Germany, Bayer Co. Ltd.
Dr. Hofmann
Synthesized Aspirin

1899 it was marketed as Asprin

acetylsalicylic acid
pain reliever "aspirin" is still one of the most popular drugs

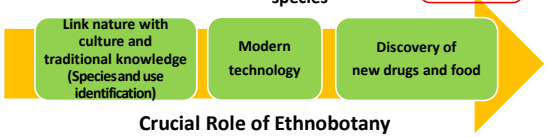
- Medicinal plants rich in phytochemicals have been used for centuries in treatment ad prevention of diseases.
- Several compounds and their synthetic or semi-synthetic analogs are in therapeutic use.

Medicinal Plants in Nepal[1]



Rural populations dependence on herbal remedies is 80%

Shrestha et al. (2000): MAPDON/ MAPs-Net Nepal: 2008. (ESON)



Crucial Role of Ethnobotany

[1]Ghimire, S.K., 2008. Medicinal plants in the Nepal Himalaya: Current issues, sustainable harvesting, knowledge gaps and research priorities. Medicinal plants in Nepal: an Analogy of Contemporary Research. Ecological Society (ECOS), Nepal, pp.25-42.

Bio-prospecting of Underutilized Plants of Nepal
ESON-KRIBB Collaboration (2012-2015)

Ethnobotanical Society of Nepal (ESON)

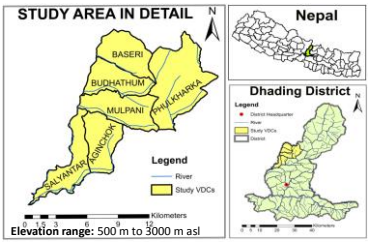
Korea Research Institute of Bioscience & Biotechnology (KRIBB)

Tribhuvan University, Nepal

- Central Department of Botany (CDB)
- Central Department of Biotechnology (CDBT)

Study Area

Ethnic communities:
- Tamang
- Gurung
- Brahmin
- Chhetri
- Newar



Elevation range: 500 m to 3000 m asl

Plants selection
- Underutilized Ethnomedicinal plants.
- Documented habitat features, photographs, herbarium of 200 plant samples.
- Primary data collected from communities, the Indigenous Local Knowledge (ILK) holders.
- Secondary data collected from ethnobotanical literature.
- 24 important plant species were analyzed in first phase in Nepal; and Korea for further analysis.

Resource mapping (by local communities)

①. Location of ILK holders * ILK Informants (Local)
$.Hotspots of MAPs ¥ Potential plant resources

Flow Chart of Research

Methanol Extract
(100 g plant sample extracted with 750 mL methanol)

Tribhuvan University

- Quantitative Assay
  - Total Flavonoid
  - Total Phenolic
  - Antioxidant Assay
- Biological Assays
  - Antibacterial Screening
  - Anticancer Screening in HeLa cell line

Korea Research Institute of Bioscience & Biotechnology (KRIBB)

- Biological Assays
  - Anti-inflammatory Assay in 264.7 RAW murine macrophage cells
  - Anticancer Assay in HL-60, SNU-1, HT-1080, A-549, MCF-7, HepG2
  - Larvicidal Assay in *Aedes aegypti*

Outcome of Dhading Based Research at Tribhuvan University

Thesis title: Phytochemical Screening, Antioxidant and Antibacterial Activity of Some Underutilized Medicinal Plants of Dhading District, Nepal - Yadu Nath Paudel

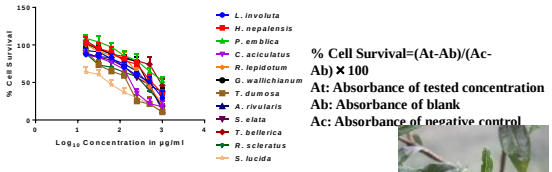
Thesis Title: Bioactive Compounds and Biological Activities of Some Medicinal Plants from Central Nepal - Gyandra Prasad Ghimire

Plant species for which bioactivities evaluated in Nepal and Korea

S N	Latin name / Local name	Parts Use	Ethnobotanical Use
1.	*Anemone rivularis* Buch.-Ham. ex DC.	Whole plant	Cough and fever
2.	*Chrysopogon aciculatus* (Retz.) Trin. ('Siru')	Whole plant	Cuts, wounds; delivery problem
3.	*Desmodium gangeticum* (L.) DC. ('Saalparmi')	Root	Gastritis, dysentery
4.	*Desmodium heterocarpon* (L.) DC. ('Bhatte ghans')	Whole plant	Gastritis, skin disease
5.	*Diospyros lancifolia* Roxb. ('Tendu')	Fruit	Diarrhoea, dysentery, fever
6.	*Geranium wallichianum* D. Don ex Sweet	Root	Gastritis and female problems
7.	*Hydocotyle javanica* Thunb. ('Ghodtapre')	Whole plant	Fever
8.	*Hypericum japonicum* Thunb.	Whole plant	Indigestion, dysentery, fever
9.	*Loxogramme involuta* (D. Don) C. Presl	Whole plant	Cuts and wounds
10.	*Maclura cochinchinensis* (Lour.) Corner ('Dambar kanda')	Bark	Gastritis, wound
11.	*Maoutia puya* (Hook.) Wedd. ('Chiple ghaans')	Root	Indigestion, gastritis
12.	*Millettia fruticosa* (DC.) Baker ('Gaujo')	Bark	Gastric, stomach disorder
13.	*Phyllanthus emblica* L. ('Amala')	Bark	Stomach uneasiness
14.	*Ranunculus sceleratus* L.	Whole plant	Blisters, Gastric
15.	*Rhododendron lepidotum* Wall.ex G. Don ('Sano chimal')	Leaf, stem	Rheumatic pain and Syphilis
16.	*Rohdea nepalensis* (Raf.) N. Tanaka	Root	Cough, gastritis
17.	*Rubus nepalensis* (Hook. F.) Kuntze ('Aaiselu')	Whole plant	Stomach pain
18.	*Scurrula elata* (Edgew.) Danser ('Aainjeru')	Branches	Bone fracture, dislocation
19.	*Symplocos lucida* (Thunb.) Siebold & Zucc. ('Lodh')	Bark	NA
20.	*Tadehagi triquetrum* (L.) H. Ohashi	Whole plant	Diarrhoea
21.	*Terminalia bellirica* (Gaertn.) Roxb. ('Barro')	Fruit	Fever, Anthelmintic
22.	*Tsuga dumosa* (D. Don) Eichler ('Gobre salla')	Bark	NA
23	*Urena lobata* L. ('Bhende kurro')	Root	Diarrhoea, dysentery

344

Cytotoxicity of Plant Extracts in in Human Cervical Cancer (HeLa) Cell



% Cell Survival=(At-Ab)/(Ac-Ab) × 100
At: Absorbance of tested concentration
Ab: Absorbance of blank
Ac: Absorbance of negative control

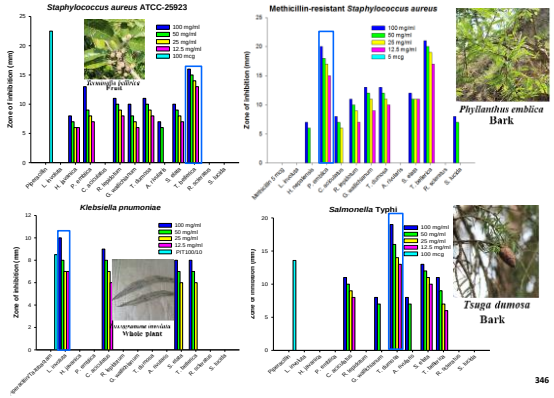
S. No.	Plant extracts	EC_{50} µg/ml
1.	*Loxogramme involuta* (D. Don) C. Presl	412.9
2.	*Hydocotyle javanica* Thunb.	574.9
3.	*Phyllanthus emblica* L.	991.6
4.	*Chrysopogon aciculatus* (Retz.) Trin.	177.6
5.	*Rhododendron lepidotum* Wall.ex G. Don	389.7
6.	*Geranium wallichianum* D. Don ex Sweet	560.1
7.	*Tsuga dumosa* (D. Don) Eichler	122.3
8.	*Anemone rivularis* Buch.-Ham. ex DC.	345.6
9.	*Scurrula elata* (Edgew.) Danser	304
10.	*Terminalia bellirica* (Gaertn.) Roxb.	1048
11.	*Ranunculus sceleratus* L.	249.4
12.	*Symplocos lucida* Thunb. ex Murray) Siebold & Zucc.	52.22

Symplocos lucida
Bark

Cytotoxicity in Human cervical cancer (HeLa) cell
EC_{50}52.22 µg/ml

345

Antimicrobial Activities of Methanolic Plant Extracts



346

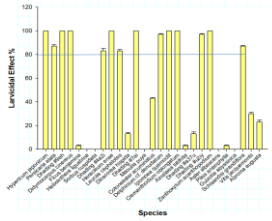
Mosquito control is concerned with several vector-borne diseases

Aedes aegypti

- Synthetic insecticide can lead to
  - ecological hazards
  - development of resistant strain,
  - harmful effect on non-target organisms
- Natural products can have less harmful effect due to their innate biodegradability.

Aedes aegypti Vector of
- Dengu
- Yellow fever
- Chikungunya
- Zika virus

- 40 µl of 500 ppm the plant extract tested on *Aedes aegypti* larvae
- More than 80% larvicidal effect on *Aedes aegypti* were shown by 14 species



Nepalese Sumac *Rhus parviflora* Roxb.

Researcher: Dr. Sabina Shrestha

2010-2013 research conducted in Kyung Hee University, S. Korea

Findings Reported

- First report of 45 compounds from *R. parviflora*
- Low Density Lipoprotein-oxidation Inhibition
- Potential neuro-protective inhibition of CDK5/p25
- Inhibition of Lipopolysaccharide-induced Nitric Oxide Production in RAW 264.7 Macrophages
- Attenuate Glutamate-induced Neurotoxicity in HT22 Cells
- Induction of Sleep
- Cytotoxic and Neuro-protective effect
- Inhibition of Cyclin Dependent Kinases

Research Outcome:

Compounds Isolated: 45

Publications: 8

Patent Rights: 2

•KR 201610748 A 20160128
nerve protection from oxidative stress

•KR 201610747 A 20160128
preventing and treating neurodegenerative disease

348

Future Perspective of Indigenous and Local Knowledge

- Achieve the national goal for the bioprospecting of ethno-medicinal plant resources
- Infrastructure development
- Capacity building (training, exchange visits)
- Regular publication of journals, reports, proceedings etc.
- Organization of conferences and training workshops
- *in-situ* and *ex-situ* conservation for sustainable harvest
- Collaboration for technology and research

Targets

- Develop high value added natural drugs / nutraceuticals
- Ensure Patent Rights (PR)
- Honor Intellectual Property Right (IPR)
- Equitable sharing of benefits for community development Economic development of Nepal

Species of Himalayan Raspberry *Rubus* (Rosaceae) in Nepal

1. *Rubus acuminatus*
2. *Rubus alexeterius*
3. *Rubus amabilis*
4. *Rubus biflorus*
5. *Rzubus calycinoides*
6. *Rubus calycinus*
7. *Rubus ellipticus*
8. *Rubus ferox*
9. *Rubus fockeanus*
10. *Rubus foliolosus*
11. *Rubus fragarioides*
12. *Rubus griffithii*
13. *Rubus hamiltonii*
14. *Rubus hibiscifolius*
15. *Rubus hoffmeisterianus*
16. *Rubus hypargyrus*
17. *Rubus indotibetanus*
18. *Rubus lanatus*
19. *Rubus lineatus*
20. *Rubus macilentus*
21. *Rubus mesogaeus*
22. *Rubus nepalensis*
23. *Rubus niveus*
24. *Rubus paniculatus*
25. *Rubus pentagonus*
26. *Rubus pungens*
27. *Rubus reticulatus*
28. *Rubus rosifolius*
29. *Rubus rugosus*
30. *Rubus splendidissimus*
31. *Rubus sumatranus*
32. *Rubus thomsonii*
33. *Rubus treutleri*
34. *Rubus wallichianus*

ESON-KRIBB Research Result
Free radical scavenging
Capacity of *Rubus ellipticus*
DPPH 72 %
ABTS 96 %
Superoxide 73 %


Rubus nepalensis


Rubus ellipticus


Rubus paniculatus

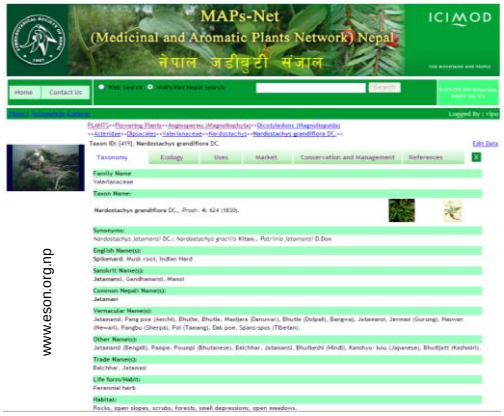

Rubus hoffmeisterianus


Rubus ellipticus

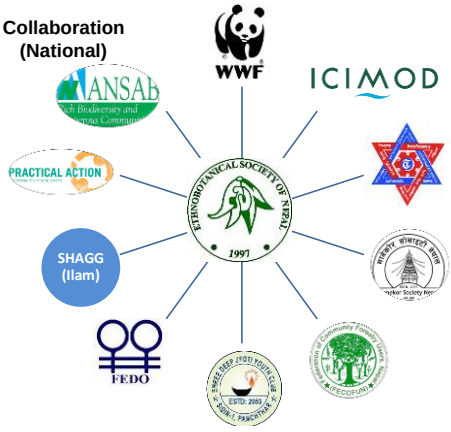
Scaffold of applications in addition to drug discovery

- Nutraceuticals
- Functional food
- Condiment, beverage, candy, cracker, cookies
- Cosmeceutical products

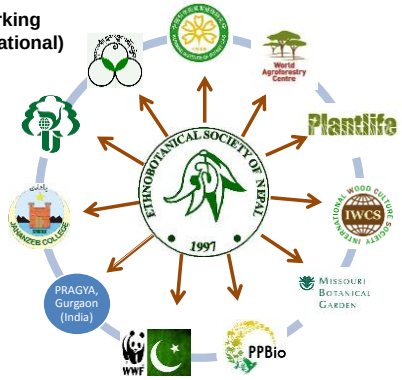
Rubus ellipticus wine



Collaboration (National)



Networking (International)



The Way Forward

Need of bioprospecting of Nepalese plant resources

- Species loss due to degradation of habitat and climate change
- Validate indigenous and local knowledge
- Isolation and characterization of bioactive components to find potential species for novel herbal drugs nutraceuticals development
- Establishment of ISO certified modern research laboratories for the Natural product research in Nepal

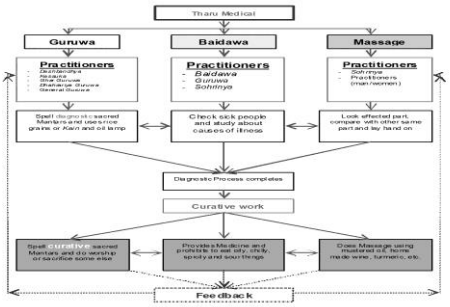
Tharu Indigenous Knowledge and Medical System

Dr. Gopal Dahit Tharu
gopaldahit.nepal@gmail.com
00977-9851119139
Nepal

Scheme of Presentation

1. Introduction of Tharu Indigenous Knowledge and Medical System
2. Definition of Tharu Indigenous Knowledge and Medical System
3. History of Tharu Medical System
4. Types or classification of Tharu Medical System
5. Tharu Medicinal Plants and Baidawa system
6. Importance of indigenous Tharu Medicinal plants
7. Specific issues of Tharu Medical System

1. Introduction of Tharu Indigenous Knowledge and Medical System ..



2. Definition of Tharu Medical System

- ".. Tharu medical system is originated by Tharu wise medicates and/or saints as per needs and priorities based on spiritual salvation, divine grace and devotion & empirical practice of using medicinal plants, which has been transforming initially through family members and now one generation to another in oral form".

3. History of Tharu Medical System

- *"Gurbaba"* his son *Ghanpat Gurwa* had 4 sons, name, *Dahit, Madwa, Demanraura* and *Pachhaldangya*. According to Tharu myth *"Gurbabak Jarmauti"*, Gurbaba created an earth and all living beings in the world.
- He had broad knowledge of all kinds of education and practices. So, after creating living being, he taught medical knowledge to his son Ghanpat Gurwa. And again Ghanpat Gurwa taught all of the medical knowledge to their 4 sons. And entire 4 sons went learning center to have additional knowledge, and returned after learning. So, entire 4 sons were perfect both in shaman works and use of medicinal plants.

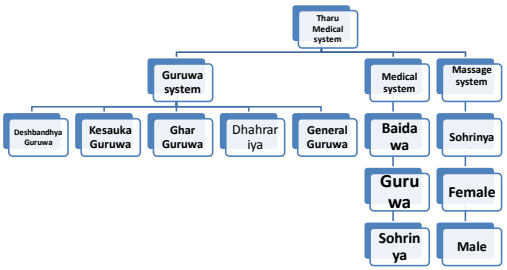
3. History of Tharu Medical System...

- After long through, at the time of separation, an elder son *'Dahit'* provided middle of Dang, which is called *Chhilly Praganna*, second elder son *'Madwa'* got east part of Dang-Deukhuri and the youngest son *'Pachhaldangya'* received western part of Dang, which is called *Pachhalapath*. And son *'Demanraura'* did not accept their ruling area; and requested to allow him everywhere without any restriction.
- Under their ruling state each of son of Ghanpat Gurwa served their people doing their best. The people were happy and healthy. So, *Dahit*, *Madwa* and Pachhaldangya still get respect and worship within their ruling area whereas *'Demanraura'* in everywhere.

3. History of Tharu Medical System...

- **It means that at the primitive time, *Gurbaba, Ghanpat Gurwa, Dahit, Madwa*, *Demanraura* and *Pachhaldangya* were only the practitioners of sacred Mantar and medicinal plants. Long after, other clan Tharus learnt Mantars from Guruwa of above 4 clans of Tharus and started to do shamanism work.**
- **Now days, *Dharkatuwa, Katkatawa, Ghotaili, Kusamya* and clans of Tharus have also been doing Medical and shaman works.**

4. Classification of Tharu Medical System



Importance of Tharu indigenous Knowledge of using Medicinal plants

- **Identity preservation perspective**
- **Culture preservation and promotion perspective:**
- **Income Generation Perspective:**
- **Medicinal perspective:**
- **Environment Protection perspective:**
- **Cost effective treatments:**
- **No side effects:**

7. Specific issues of Tharu Medical System

- **Tharu medical system has basically three types of practices, these are still in existences, name, Tharu Mantars, which is practiced by Guruwa, Medicinal plants, which are used by Baidawa; and Massage, which is practiced by Sohrinya and other skilful practitioners. This indigenous knowledge was in wide practice from very beginning to origin of Tharu. But, now, this knowledge is in endangered situation.**
- **The quality, quantity and frequency of using Tharu medical system is decreasing day to day. This is because of internal and external causes. External factors are mainly of government rules and regulars, Hill and southern migration, globalization, increasing practice of yellow-peptic practices, etc. And Internal factors are decreasing quality and strength of knowledge, not adopting modern technology and equipments, no systematic learning process, no documentation of knowledge, etc.**
- **Tharu medical practitioner Baidawa and Guruwa have traditional authority but not legal certificate from Nepal government. Due to not having authorized legal certificate, they have been facing lots of problems and demoralize to continue their practices smoothly.**

7. Specific issues of Tharu Medical System ...

- Interested youth Tharu learns Mantars individually from Tharu Guruwa and Baidawa, there is no any well managed school and different levels of text books. They learn through oral transformation system. There is need of legal institution (school or Gurukul) who can manage learning process and develop text of different levels.
- Tharu Baidawa also teaches their indigenous knowledge through oral transformation and some time by providing practical opportunity but this is not sufficient.
- Regular practice of Medical practitioners is threatening by non-Tharus and some time by Tharus also. They also face problems from local police and administration. So, they have needed of Identity cards and legal certificates to do and continue their jobs.

7. Specific issues of Tharu Medical System ...

- Diseases diagnosis procedure and modes of preparing medicines are old type of, no use of modern technologies. Capacity building training and use of modern equipments makes Tharu medical system more effective and impressive also. But it is very expensive, they cannot afford for it, government should support them.
- Government have never given attention to establish authorized institution that can provide technical, managerial, promoting, legal and quality maintenance works.
- The quality and strength of Mantars are decreasing, valuable knowledge of Mantars is vanishing together with the death of qualified Guruwa and inventory is also getting low. So it has become very essential to script or prepare written documents of it. It is only be possible if government prepares clear policy, rule and provide sufficient budget for study, documentation and publication.

7. Specific issues of Tharu Medical System ...

- It is listed 600 species of medicinal plants as per indigenous knowledge of Tharus. But it is not final, its inventory of species can sure increase if detailed and dept study is carried out in all over Tharuhat region (Tarai and Inner Tarai districts). This study work is also only be possible if government and international agencies provide sufficient budget for study, documentation and publication, qualified manpower for doing empirical study, indigenous peoples' participation for faire identification and legal authority for ownership building and benefit sharing.
- It has another prioritized need to establishment of Tharu medicinal plant production and purification company based on Tharu indigenous knowledge of using, medicinal plants. It provides many services like good opportunity of employment, good prices in medicinal plants, medicines at their doors in cheapest prices and bonus to Tharu community as well.
- Tharu medical practitioner Badawas had collected medicinal plants from nearby jungle but all these jungle authorities had prohibited to collect such medicines. It is another serious cause of not giving continuity the Tharu medical practices.

7. Specific issues of Tharu Medical System ...

- Expert people from Nepal and outside Nepal, they come and carried out study work about the medical practices and medicinal uses of Tharu; then they registered these indigenous knowledge and plant species in own name, not in collective name of Tharus. This is another example of cheating Tharu indigenous knowledge against Tharu community.
- There is a lot of room to do awareness raising among the Tharu youth, systematic documentation (e.g. Indigenous knowledge data collection, digitization, recording and repository); institutional strengthening (through revitalizing Traditional Tharu Institutions such as Badghar or Guruwa).
- There is general trend that different knowledge systems are integrating, learning and getting enriched from each other building complementary and synergy especially with **modern knowledge and technology**. But Tharu Medical practitioners (Baidawas) have lagging such connections.

7. Specific issues of Tharu Medical System ...

- There is demand for and need to increasing the standards, quality efficacy of the Tharu medicine by doing chemical analysis of important formulations in collaboration with Government of Nepal's Ayurvedic Department and other relevant institutions. But such demands are not entertained by corresponding government agencies.

Vote of thanks

Annex 3: Sub-regional ILK networking

Annex 3-1: Preliminary proposal of IGES for the sub-regional networking and facilitation related to ILK

Table 3-1: The summary of preliminary proposal of IGES for the sub-regional networking and facilitation related to ILK

1. Draft criteria for the participating organizations to the network The preliminary draft criteria have been prepared to identify target organizations to participate in the network. There are three criteria: 1) To have work/research experiences on ILK; 2)To be expected to continue their work; and 3) To have interest in contributing to IPBES or similar assessment processes
2. Expected activities of the network (examples) A list of expected activities of the network has been prepared to identify the nature of the network. However, actual activities practiced by the network will be largely affected by members of the network or hubs. Therefore, the list is considered as an example of activities that will help network members to develop a concrete list of activities by themselves. It would be also necessary to consult IPBES experts about their needs for the network in the course of development of the network. The examples of expected activities are: 1) To identify ILK Holders/Experts; 2) To gather information on documentation relevant to ILK; and 3) To interpret ILK into the relevant language or context usable to assessment processes.
3. Steps to establish networks Below are the tentative steps to establish the networks, hubs or other relevant frameworks to facilitate and networking ILK community with IPBES community: • Step 1: Prepare questionnaire requesting participants of the sub-regional workshops to identify the needs, suggestions, concerns, and questions related to such networks. • Step 2: IGES compiles the results, analyses them, and shares the results of the survey with participants during the sub-regional workshops and conducts discussions as part of the consultation process.

- Step 3: Establish a preliminary network by inviting interested participants of respective workshops with revised criteria, activities and procedure that reflects the needs of each sub-region.
- Step 4: Prepare application procedures and open a call for new additions to expand network members.

Annex 3-2: Results of the Questionnaire for sub-regional ILK networking

Table 3-2-1: List of the target regions, countries, and communities **by Organization**

Name of organization	**Country**	**The target Regions**	**The target countries**	**The target communities**
Organization A	Iran	West Asia	Iran	The Boompajuhan Society is a registered environmental NGO active in Iran, which works in different local communities in various provinces in Iran.
Organization B	Pakistan	West Asia	Pakistan	-
Organization C	Nepal	-	Whole of Nepal	-
Organization D	India	North-East India	India	-
Organization E	Nepal	Hindukush Himalaya region that covers the mountains of South Asia and China, In collaboration with China, India and Bhutan	Nepal, South Asia and China, India and Bhutan	Local communities in the far western and eastern districts of Nepal
Organization F	Nepal	South Asia	Nepal, Tarai region	Tarai region, Indigenous people
Organization G	India	Western Ghats, India	India	The Kaani indigenous people, who are forest dwellers in Kanyakumari district in the Western Ghats, India. They live deep in the hilly, rain forests.
Organization H	India	Asia Pacific region	-	Natural world heritage site managers, stakeholders and local community
Organization I	Nepal	South Asia	Nepal	Inhabitants of Manaslu Conservation Area

Name of organization	Country	The target Regions	The target countries	The target communities
				(Gorkha); Sagarmatha National Park (Solukhumbu) and; Kangchenjunga Conservation Area (Taplejung) Nepal

Table 3-2-2: List of the target activities, issues, fields of the activities relevant to ILK and major languages **by Organization**

Name of organization	The target activities, issues, fields of the activities relevant to ILK	Major languages
Organization A	While the NGO is working on community management on water, forest, and protected areas in various areas, it has other projects on ecosystem services, women's participation, waste management, and poverty reduction. In most of the projects, ILK is an important component of our work. In forest, we are working to register the local knowledge of herders in forest, while at the same time, we are working on community management on Qanat in Kerman, North Khorassan and Kermanshah. The NGO has established a knowledge management team in which not only it works on the patterns of local development, it aims to conserve ILK since in most communities we are working, ILK is a major component.	English, Persian
Organization B	One of the missions of our organization is to develop a rich multi–lingual resource centre in the areas of interest to the University. Department of Environmental Science, International Islamic University Islamabad, Pakistan has recently initiated Landscape development and Biodiversity Conservation Program that is related to ecosystem restoration and conservation of habitats, priority species and the indigenous and local knowledge about plants across the country and in the region.	Arabic, English and Urdu
Organization C	Education, research, training/capacity building.	English, Nepali
Organization D	Research and documentation.	English
Organization E	We are involved in the documentation of indigenous peoples and local community for promotion and preservation of ILK. Major fields of activities include; ethnoecology, sustainable clean energy sources, spring sheds and watersheds, innovative livelihood options for depended people on natural resources who are predominantly ILK.	Nepali, English, Hindi
Organization F	Carry out research on Indigenous knowledge and practices, doing advocacy for protection and promotion of rights of IPRs.	Tharu, Nepali and English
Organization G	Forest Conservation incorporating the Kaani indigenous people. Wildlife conflict is a major issue, that no one can	English, Tamil,

Name of organization	The target activities, issues, fields of the activities relevant to ILK	Major languages
	operate agriculture & harvest the produce. The indigenous peoples have a lot of ILK to counter the wild animals that raid their crops. They have also many ILKs pertaining to fishing, medicinal plants, ethno-medicine, etc.	Malayalam & Kaani dialectical language.
Organization H	Capacity building and training for Natural world heritage site managers, stakeholders and local community. ILK may be explicitly addressed under cultural landscapes and mixed nominations.	English, Hindi
Organization I	Specific Objectives: -To identify and analyse threats and opportunities related to climate change in mountain belt of Nepal Himalaya. -To study how different levels of land-use intensity (from primeval forests to arable fields) do affect biodiversity. The organisms studied include plants, lichens, mushrooms, butterflies, birds and Red Listed mammals (Flagship species). -To document ILK on Himalayan biota with main focus on lichens, mushrooms, and higher plants.	Nepali, English

Table 3-2-3: List of views on the needs for possible functions of the sub-regional network **by Aspects**

Aspects	View on the needs for possible functions of the sub-regional network
Institutional/ Policy	- Fund-raising mechanisms/mechanisms at sub-regional level. (2) - Facility with which common problems and strategies are agreed upon. (1) - Conduct discussions and dialogues to bring convergence and synergies between ILKs and science. (1) - Explore ways and means to bring ILKs into policy, strategy, and planning at different levels. (1) - Define coordination modalities. (1) - National and local coordination. (1) - Find efficient and equitable cost-sharing mechanisms. (1) - Sub-regional mechanisms can increase political influence at the world level. (1)
Collaboration/ Sharing	- Physically participate and share the relevant ILKs. (1) - Build collaboration between ILK holders and other stakeholders. (1) - Develop an online network for sharing knowledge and best practice. (1) - Binds ILK network members. (1) - Maximize mutual understanding and benefits. (1) - Identification and dissemination of information pertaining to ILK. (1) - Sub-regional mechanisms to be a step toward the integration of different countries' scientific and indigenous systems. (1) - Sub-regional network must be able to bind ILK network members and maximize mutual understanding and benefits. (1)
Research/ Documentation	- Start research on new topics while avoiding unnecessary costs or risks for each country/Carry out research work. (2) - Sub-regional modalities bring to shared research/ Put resources for joint research in order to increase the effectiveness for different countries in a same region. (2)

Aspects	View on the needs for possible functions of the sub-regional network
	- Highlight and document Indigenous knowledge. (1) - Identify and document the contribution of ILKs to conservation and sustainable use of biodiversity and ecosystems. (1) - Systematically promote documentation, utilization and benefit sharing of and from ILK use. (1)
Awareness/ Recognitions	- Basic awareness on forest conservation should be imparted to the cross-section of society with environmental literacy. (1) - Recognize and support rights and interests of indigenous people and local communities. (1) - Recognize and respect intellectual and cultural property rights. (1)
Capacity Building/ Training	- Training. (1) - Conduct workshops time to time to address issues of conflicts. (1)
Others	- Share and transfer ILKs in a more efficient manner. (2) - Coordination modalities/Sub-regional modalities. (1) - Promote to deal with problems that cross the boundaries of a single country. (1) - ILK best practices in the protected area is expected. (1)

Table 3-2-4: List of challenges, concerns, and suggestions for possible functions of the sub-regional network **by Aspects**

Aspects	Challenges, concerns, and suggestions for possible functions of the sub-regional network
Awareness and Decreasing/loss of the knowledge	- Due to strong implication in the indigenous community that globalization, communication revolution and free trade have, ILKs will be lost soon. (1) - Environmental awareness is very low among the people. (1) - Conflicts between ILK holders and experts. (1) - ILK disappearing day by day and governments in the region are not providing any financial, policy and institutional support (1) - The costs of sub-regional network for collaboration have decreased. (1)
Financial	- Several countries can be financed through one initiative. (1) - Effective ILK Sub-regional network work with the cooperation with Government, national NGOs and regional NGOs; A). Mainstreaming of ILK at country level, sub-regional level and local level; and b0. effective participation of ILK holders and ILK experts. (1)

Table 3-2-5: List of view on the needs, challenges, concerns, suggestions for possible functions of the sub-regional network **by Organization**

Name of Organization	View on the needs, challenges, concerns, suggestions for possible functions of the sub-regional network
Organization A	Training and sharing knowledge could be a major need of any organization. Language could be a challenge. For instance, the local knowledge on Qanat in Iran uses words and terms that cannot easily be translated in English. Even, they change from one region to another in Iran. Translation into English could not be sufficient to share the knowledge. Access of local communities to a sub-regional network could be another challenge (the language barrier or the limited access to the Internet). Funds for visiting or sharing knowledge can be a major concern too. A

Name of Organization	View on the needs, challenges, concerns, suggestions for possible functions of the sub-regional network
	fund-raising mechanism might be necessary.
Organization B	Sub-regional network for collaboration can be promoted to deal with problems that cross the boundaries of a single country. Frequently, different countries in a region confront the same problems simply because they share the same floristic, climatic and edaphic conditions. Putting together resources for joint research can increase the effectiveness with which the region resolves the problems at hand. The effectiveness of sub-regional initiatives depends on the facility with which common problems and strategies are agreed upon, coordination modalities are defined and efficient and equitable cost-sharing mechanisms are found. The costs of sub-regional network for collaboration have decreased over the past decade due to immense progress in means of communication (telephone, fax, e-mail, Internet, airline services). Sub-regional modalities bring additional advantages to shared research. Indigenous local Knowledge can be shared and transferred in a more efficient manner; research can start on new topics while avoiding unnecessary costs or risks for each country. Sub-regional mechanisms can also increase political influence at the world level and be a step toward the integration of different countries 'scientific and indigenous systems. Donors are normally interested in sub-regional mechanisms as several countries can be financed through one initiative.
Organization C	Needs: 1) Identifying and documenting contribution of ILK to the conservation and sustainable use of biodiversity and ecosystems. 2) Exploring ways and means to bring ILK into policy, strategy, and planning at different levels. 3) Recognizing and supporting rights and interests of indigenous peoples and local communities. 4) Recognizing and respecting intellectual and cultural rights. 5) Conducting discussion and dialogue to bring convergence and synergies between ILKS and science. 6) Building collaboration between ILK holders and other stakeholders Challenge: Bringing convergence and synergies between ILK systems and science, and between ILK holders and other stakeholders interests
Organization D	N/A
Organization E	Needs: Active sub-regional network is needed to systematically promote documentation, utilization and benefit sharing of and from ILK use. Challenge: Resources to run an effective and coordinated network Concerns: ILK has been disappearing day by day, and governments in the region are not providing any financial, policy and institutional support. Suggestions: XXX as an academic, research and outreach institutions supported by the Govt. of Nepal can bring national NGOs such as XXX and regional organizations such as XXX to make the ILK Sub-regional network work effectively a). Mainstreaming of ILK at country level, sub-regional level and local level; and b). effective participation of ILK holders and ILK experts

Name of Organization	View on the needs, challenges, concerns, suggestions for possible functions of the sub-regional network
Organization F	There is conflict in between ILK holders and experts because majority experts are from non-ILK holder community. So, there is need of conducting such workshops time to time to address issues of conflicts.
Organization G	The indigenous knowledge should be documented. Or they will vanish as the present generation is not interested in it. The present globalization, communication revolution and free trade have their strong implication in the social, economic, cultural spheres in the indigenous community that the ILKs will be lost soon. ILK of the community is not documented yet. So a sub-regional network is essential to highlight them & document them. Also basic awareness on forest conservation should be imparted to the cross-section of society with environmental literacy, as environmental awareness is very low among the people.
Organization H	The sub-regional network could focus on developing an online network for sharing knowledge and best practices. The group could be actively involved in identification and dissemination of information pertaining to ILK.
Organization I	Sub-regional network must be able to binds ILK network members and maximize mutual understanding and benefits.

Table 3-2-6: List of contributions from organizations to the network **by Aspects**

Aspects	Contributions from organizations to the network
Facilitation/ Coordination/ Communication	- National and local coordination/collaboration. (2) - Facilitation/Support for communities to join the platform. (2) - Continue to work on local knowledge/Promotion and share ILKs. (1) - Community-based approach as a NGO. (1) - Participate physically and share the relevant ILKs, such as Kaani indigenous community, our practical experience of local and migratory avifauna, and knowledge on Olive Ridley Turtle. (1) - Communication and technical support services for the network. (1) - Institutions applying the ILK knowledge which is acquired from the ILK holders (through the research projects). (1)
Institutional Support	- Play a vital role in the establishment of the proposed sub-regional network. (1) - To overcome the challenges and address the needs through education, research, capacity buildings, and facilitate. (1) - Monitoring and evaluation. (1) - Carry out research work when required. (1) - ILK can be documented (1) - Develop regional hub of ILK holders, ILK experts and experts on indigenous and local knowledge and willing to provide; a) office space; b) IT support; c) faculty time; and d) graduate students to do research, documentation, and application. (1)

Table 3-2-7: List of contributions from organizations to the network **by Organization**

Name of Organization	Contributions from your organization to the network
Organization A	As the NGO is active in various fields with a community-based approach, it is much interested to continue to work on local knowledge and its promotion in Iran.

Name of Organization	Contributions from your organization to the network
Organization B	Our organization as being an International University working in the capital city of Islamabad and strongly inter linked with the national, international and regional communities, can play a vital role in the establishment of the proposed sub- regional network. It can provide coordination, collaboration, monitoring and evaluation, communication and technical support services for the network.
Organization C	Our organization can contribute to address the needs listed above through education, research, capacity building, and facilitate to overcome the challenge listed above.
Organization D	Share ILK available with us
Organization E	We want to develop a regional hub of ILK holders, ILK experts and experts on indigenous and local knowledge and practices for which XXX is willing to provide: a) office space; b) IT support; c) Faculty time; and d) graduate students to do research, documentation, and application.
Organization F	National and local coordination, facilitation and carry out research work as and when required.
Organization G	We can physically participate and share the relevant ILKs. The Kaani indigenous community has lot of materials and knowledge on ethno-botany and medicinal herbs and treatment through indigenous methods. We can contribute them. We have practical experience on local & migratory avifauna that visit the southern tip of India. Also on knowledge on Olive Ridley Turtle and their nesting and hatching of eggs & Honey bee conservation. We can share the knowledge on these.
Organization H	ILK best practices in Protected Areas (Natural heritage sites) of Asia-Pacific region can be documented by our centre.
Organization I	I am committed to provide contribution to the society and concerned institutions applying the ILK knowledge which I have been acquired from ILK holders. This knowledge will help to find out the gap between users and conservation practices. This leads towards the new frontiers of research and long term human well-being as identified by IPBES.

Table 3-2-8: List of ideas and suggestions to secure the sustainability of the network **by Aspects**

Aspects	Ideas and suggestions to secure the sustainability of the network
Coordination/ Communication	- Become a sustainable institution through a regular communication of users. (1) - Defined clearly interests of experts and ILK holders. (1) - Regular communication of users through a dedicated focal point. (1) - Emphasize action related to problems or topics not affecting intra-regional competitiveness, but rather focusing on partner countries' internal conditions (e.g. ILKs of trade value, natural or genetic resources), or working on pre-competitive topics). (1) - Awareness raising on ILK to raise awareness of policy makers to practitioners. (1) -Not to be limited to only one connection from each county. (1) - Focus on shared problems rather than a shared interest or discipline. (1) - Face to face meeting and completion of tasks under attainable targets for AP region. (1)
Institutional Support/	- Basic budgets to conduct, support research, and activate smoothly. (3) - Digital platform to share the knowledge from the local communities. (1)

Aspects	Ideas and suggestions to secure the sustainability of the network
Facilities	- A Small Secretariat with one Network coordinator will run the network with support from Institutional management, faculty and students. (1) - Permanent secretariat for addressing the concerns systematically across the region. (1)
Research/ Documentation	- Motivate/Enerzize members to carry on their research. (2) - Promote and prioritize research on ILK: by utilizing student's Master's & Ph.D. thesis work. (1) - Sub-regional research with the results permitting each partner to benefit without other partners being hurt. (1) - Collect and document ILKs. (1)
Membership	- Require extensive membership to represent all major knowledge systems in the network to address systematically. (1) - Proper criterion for being a member of the network. (1) - Vivid concept, scope, TOR of Networks and its member. (1) - Actions should be oriented to motivate members to carry on their research on ILK related field. (1)
Training	- Periodic trainings and sharing among members/Organize periodic workshops and meetings/ trained human resources (4) - Take up the lack of knowledge on best practice in the region as the first task to fill in the gap. (1)

Table 3-2-9: List of challenges or constraints from participants to secure the sustainability of the network **by Aspects**

Aspects	Challenges or constraints to secure the sustainability of the network,
Documentation/ Language	- Language barrier or limited access to the Internet. (1) - None of the indigenous persons has documents such as a passport to travel. (1) - Partners prefer not to share research results that affect advantage vis-à-vis potential competitors. (1)
Financial	- Financial (1) - Financial, institutional and none or poorly responding network members, coordination among stakeholders (promoting national networks), research based policy intervention (link to CBD and IPBES functions and deliverables) and harmonization of ILK and technological advancement (integration based on the local and national needs and circumstances) (1)
Others	- Difficulty of working on topics that affect the relative competitiveness of the partners. (1) - Collaboration ends when the problem no longer requires attention. (1) - Finding the relevant ILK persons and gathering them. (1) - Motivation, trained human resources, or lack of knowledge on best practices in the region. (1)

Table 3-2-10: List of ideas and suggestions to secure the sustainability of the network, challenges or constraints from participants **by Organization**

Name of Organization	Ideas and suggestions to secure the sustainability of the network. Challenges or constraints for it
Organization A	For a sustainable network, I think we need a digital platform to share the knowledge from the local communities. It has to expand the network within

Name of Organization	Ideas and suggestions to secure the sustainability of the network. Challenges or constraints for it
	the countries too and should not be limited to only one connection from each country. Especially the communities have to join the platform.
Organization B	Trend can be observed toward a focus on shared problems rather than a shared interest or discipline. The advantage of a problem-oriented focused network is that it permits the definition of partners' objectives, goals, and responsibilities, which in turn permits better management and evaluation of collaborative effort. The disadvantage is that the reason for collaboration ends the moment that the problem no longer requires attention. The difficulty of working on topics that affect the relative competitiveness of the partners. Research is increasingly seen as an instrument to achieve competitive advantage, and partners therefore prefer not to share results that affect this advantage vis-à-vis potential competitors. A country exporting a product to other countries in the same region will probably not want to collaborate on that product. Likewise, a country which dominates the world market probably would not want to share its results with neighbors who are possible market competitors. On the other hand, this difficulty does not arise when countries within a region together satisfy a small part of international market demand for a certain product. This suggests, therefore, that it is important to emphasize action related to problems or topics that do not affect intra-regional competitiveness, but rather focus on partner countries' internal conditions (for example, Indigenous local knowledge of trade value, natural or genetic resources), or work on pre-competitive topics (basic research). Sub-regional research may have a greater chance of success if the results permit each partner to benefit without other partners being hurt.
Organization C	Systematically addressing the concerns of diverse group of ILK holders across the region requires extensive membership to represent all major knowledge systems in the network, financial resource, and possibly a permanent secretariat.
Organization D	N/A
Organization E	Suggestions: ILK Sub-regional network should be a Nested Network with XXX playing the role of hub and national networks in South and West Asia will be the members of this network. A small Secretariat with one Network coordinator will run the network with support from XXX management, faculty and students. Promote and prioritize research on ILK: by utilizing student's thesis work Awareness raising on ILK; XXX will work together to raise awareness of policy makers to practitioners Coordination among stakeholders- A full time Network coordinator shall do this job Challenges: Financial, institutional and none or poorly responding network members Coordination among stakeholders – promoting national networks Research based policy intervention – link to CBD and IPBES functions and deliverables Harmonization of ILK and technological advancement integration based on the local and national needs and circumstances Constraints: motivation, trained human resources Financial –should start small and make self sustainable after 5 years Lack of knowledge on best practices in the region – the network should take up this as the first task to fill in the gaps.

Name of Organization	Ideas and suggestions to secure the sustainability of the network. Challenges or constraints for it
Organization F	It requires vivid concept, scope and TOR of Networks and its members. It will require basic budget to conduct and activate smoothly. Proper criteria to be member of network. Interest of experts and ILK holders should be clearly defined.
Organization G	Periodic workshops, meetings should be organized. The ILKs should be collected & documented. It can be in different places. Finding the relevant ILK persons and gathering them is a challenge. None of the indigenous persons has documents as Passport to travel.
Organization H	The network can become sustainable through a regular communication of users through a dedicated focal point. face-to-face meetings and completion of tasks under attainable targets for AP region could be one of the ways to achieve greater outputs.
Organization I	For the sustainable and longevity of this kind of network, actions should be oriented to motivate members to carry on their research on ILK related fields. Periodic trainings and sharing among the members, definitely boost the working spirit. Meanwhile, if network could support selected research concepts developed by network members, such research grants energizes members on their further work.