Introduction and Meeting Report

Traditional Forest Knowledge in the Asian Context

Traditional knowledge is a combination of ancient indigenous practices and techniques, locally adapted and distinctive to a territory or a community, which is typically packaged in folk songs, stories, dances, poetry, and carvings and paintings, and passed on through the generations. It has greatly contributed, and still does, to the world's natural and cultural heritage by sustaining the production of multiple goods and services that enhance livelihood security and quality of life. Together with its cultural values and historical perspectives, traditional knowledge has gained an increasingly important role in shaping policies towards achieving the Millennium Development Goals (MDGs) of alleviating poverty and ensuring economic, social and environmental sustainability.

Traditional knowledge has been used for managing the utilization of many natural resources, such as water, soil and forests, and for organizing rural and urban communities. Traditional Forest-Related Knowledge (TFRK) has long been known to have important implications for forest management and conservation of forest biodiversity, as well as identification of valuable genetic resources. This knowledge has historically been dynamic, responding to changing environmental, social, economic and political conditions to maintain forest health naturally and ensure that forest resources continue to provide tangible (foods, medicines, wood and other non-timber forest products, water and fertile soils) and intangible (spiritual, social and psychological health) benefits for present and future generations.

The political commitments on increasing the role of TFRK and practices in the protection of landscapes and conservation of biological diversity were reaffirmed by many of the member states of the United Nations Forum on Forests. During its Sixth Session in 2006, countries agreed to four Global Objectives on Forests aimed at enhancing sustainable forest management (SFM) and the contributions of forests to the achievement of the MDGs. The increasing emphasis on SFM, which includes ecological, social, cultural, spiritual, and economic sustainability, has prompted greater emphasis on all relevant knowledge about forest ecosystems and approaches for their management.

The Asia-Pacific region has some of the world's highest diversity of ethnicities, languages and cultures. The region is the home of very rich ancient wisdom that had been passed down through the generations. A major portion of this is directly or indirectly linked to its vast stretches of forests, which have been the lifeline for the millions of people living in and around them. Although many of these age-old techniques and practices have previously been discarded as being outdated and no longer relevant to present day forestry, increasingly they are being re-discovered and explored for solving current problems. In the process, issues such as equitable sharing of benefits and protection of intellectual property rights have surfaced.

Traditional knowledge and practices have sustained the livelihoods, cultures and the forest and agricultural resources of local and indigenous communities throughout Asia for centuries. Despite their importance and contributions to sustainable rural livelihoods, traditional forest-related knowledge and practices are fast disappearing in most Asian countries, (and indeed worldwide) for a number of reasons. Government policies and regulations within and outside of the forest sector restricting access and traditional use of forest resources, have led to a general erosion of traditional culture and of traditional land and forest management knowledge and practices. The expansion of the increasingly globalized market economies is undermining demand for traditional products and increasing the need for cash incomes in previously self-sufficient rural areas. Greater exposure to mass media and other cultural influences from metropolitan centers have led to an erosion of

traditional culture and beliefs, and declining interest in traditional wisdom, knowledge, and lifestyles among younger generations. The negative implications of this loss of TFRK on livelihoods, cultural and biological diversity, and the capacity of forested landscapes to provide forest goods and services remain poorly understood, largely unappreciated, and undervalued by policy-makers and the general public in most countries.

Against this backdrop, the international conference "Sustainable Forest Management and Poverty Alleviation: Roles of Traditional Forest-related Knowledge", was convened in Kunming, Yunnan Province, China, 17-20 December 2007. For the IUFRO Task Force on Traditional Forest Knowledge, this meeting was the third in a series of regional conferences to be held between 2005 and 2010.

The Conference

The conference was jointly organized by the Chinese Academy of Forestry, the IUFRO's Task Force on Traditional Forest Knowledge, and the Asia-Pacific Association of Forestry Research Institutions (APAFRI) in cooperation with several other organizations in Asia. The conference was made possible through the financial support generously provided by the Korea Forest Research Institute, the State Forest Administration of PR China, the Food and Agriculture Organization of the United Nations (FAO), the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, and several other organizations that provided logistical support and travel assistance to a number of conference participants. These proceedings are published with support from the U.S. Forest Service's Research and Development branch. Appendix I contains a list of sponsors, as well as a list of the members of the Scientific Committee for this conference.

A total of 70 papers and posters were presented during the three days of formal sessions. Presentations covered a wide range of local case studies, historical analyses, and multi-site study syntheses. The conference programme also included a full-day field trip to the Zixishan National Forest Park organized by the Kunming Institute of Botany and an evening cultural program in township of the Chuxiong Yi Ethnic Minority Prefecture. The detailed programme is appended as Appendix II.

The conference was attended by approximately 150 participants from 14 countries in Asia plus delegates from an additional 7 countries in the Western Pacific, Europe, and North America. The full list of participants with their contact details is in Appendix III. Delegates included researchers from numerous biophysical and social science disciplines, academicians and teachers, students, representatives from NGOs, national forest management agencies and intergovernmental organizations and bodies, as well as a significant representation of local and indigenous community members from China and several other Asian countries .

This conference also served as the venue for side meetings of Task Force core group members able to attend from Asia, Australia, Russia, and North America to finalize plans for the preparation of a global State-of-Knowledge Report to be published in 2010 – this publication will include regional overviews of key questions and issues related to traditional forest knowledge and its application to sustainable forest management as well as global syntheses and special chapters on TFRK and climate change, traditional knowledge in international forest policy discussions, IPR and access and benefit sharing issues, scientific ethics and best practices in TFRK research, among others.

Major Topics and Findings

The principal topics explored during the conference included:

- Traditional knowledge contributions to achieving poverty reduction and related Millennium Development Goals;
- The roles of traditional knowledge and management practices in sustaining cultural identity and rural livelihoods;
- Application of traditional knowledge in management of forest and agricultural ecosystems for food, forest products and environmental services;
- Challenges and opportunities for the study, preservation and enhancement of traditional knowledge to contribute to sustainable rural livelihoods and sustainable use of forest biodiversity under conditions of accelerating socioeconomic and environmental change; and,
- Policy issues and processes affecting the preservation and development of traditional forest knowledge.

Owing to the diversity of scientific disciplines, cultural perspectives, backgrounds, experiences and philosophies of the participants, the program and associated discussions were rich, dynamic and thought-provoking. From these presentations and discussions, several topics and issues emerged that appear to be common to most regions and situations regarding the cultural, economic, and ecological importance of traditional forest-related knowledge, the challenges faced by local and indigenous communities to strengthen and preserve their traditional knowledge and lifestyles in the face of global change, prerequisites for sustaining traditional forest management practices, and the appropriate role of formal forest science in helping to resolve these issues.

For example, a large number of case studies examined the rapid erosion of traditional forest-related knowledge and its connection to social, economic, and governance trends arising from within these communities and impinging on them from the broader society. These trends are associated with the influence of expanding market economies, the effects of the mass media on popular cultural values and lifestyle expectations, and land-use, transportation, economic and other policies that very often restrict opportunities for traditional forms of agricultural and forest management (traditional shifting cultivation, for example), undermine traditional communal decision-making institutions, and limit market access to forest products based on traditional practices. Lack of awareness among the general public, the media, and decision-makers about the values (environmental, social, economic, cultural) of forests to local communities and the larger society that benefits from traditional forest management practices is widespread, and opportunities for involvement of local and indigenous communities in development of forest and land-use policies that directly affect their livelihoods are rare.

On the other hand, the conference highlighted a number of encouraging local and national examples and strategies for reversing these trends. Partnerships with NGOs, government forest agencies, universities and research organizations, business enterprises, and others have helped in some cases to preserve or restore traditional use rights and access for forest-dependent communities, yielded effective joint forest management arrangements, improved rural incomes by expanding marketing access for traditional forest products, and enhanced the profile and prestige of traditional forest-related knowledge within and outside of local and indigenous communities. The conference urged governments to mainstream traditional forest-related knowledge into sustainable forest management and poverty alleviation development strategies, policies, and legislative agendas.

The Role of Forest Science

The actual and potential importance of forest science to helping protect and realize the full potential of traditional forest-related knowledge was given considerable attention during the conference. Among the major points echoed throughout the conference participants were the importance of multi-disciplinary, participatory, research (both biophysical and social sciences); the critical issue of trust and respect (for communities, their cultures, beliefs and practices) in research on traditional knowledge, and the need for such research to help solve immediate, practical problems faced by the communities in which they work.

Working with local and indigenous communities, the forest science community can contribute to the revitalization of traditional forest-related knowledge in several important ways, including:

- Documentation of TFRK in close partnership with holders and users of this knowledge, using ethically appropriate study methods;
- Research on traditional forest management conservation and practices that help to elucidate and generalize the ecological underpinnings of traditional knowledge;
- Economics, marketing and policy research aimed at improving opportunities for increasing rural incomes from products and services provided by application of TFRK;
- Integration of TFRK into forestry curricula, and partnership with the holders and users of traditional knowledge for education of the general public and decision-makers on the livelihood and environmental values of TFRK.

MOUALS' TRADITIONAL RESOURCE UTILIZATION IN THE SUNDARBANS OF BANGLADESH: A CASE OF MANGROVE FOREST PEOPLE

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Introduction

The Sundarbans Mangrove Forest (SMF) is a densely populated, green and deeply forested archipelago in the South Asian region. Sundarbans is the largest contiguous mangrove forest in the world and has been regarded as one of the most unique regions facing a furious sea belt - Bay of Bengal. This forest provides a livelihood during certain seasons of the year for an estimated 300 000 people, working variously as gatherers of honey (*Mouals*), woodcutters(*Kathure*), collectors of golpatta leaves, hantal and grass (*Bawalis*) and large numbers of fishermen (Amin & Khan 2001). The *Mouals,* the honey hunters of the Sundarbans, have tracked the bounty of the giant honeybee for a thousand years amid man-eating tigers, saltwater crocodiles, pirates, pythons and many other unknown dangers. To continue the livelihood, *Mouals*, practise a kind of interaction with the surrounding environment on the basis of local knowledge, which is unique and deeply rooted into the historical context of the Sundarbans Mangrove Forest. The traditional environmental knowledge ot the *Mouals*, also shapes up their social organizations, rituals, values, institutions and laws in using the natural resources continuously.

Methodology and Study Area

The present paper is an outcome of a field-based data collection from two villages: Kalinchi and Jotindranagar of Shamnagar Upazila under the Satkheera District. Participant observations, ethnographic interviews, FGDs and case studies were the principal tools of data collection.

Study Findings and Discussion

Although the *Mouals* are the permanent inhabitants within the forest area of Sundarbans, they never enjoy the free exploitation of Sundarbans' resources according to their needs and desire. The *Mouals* belongs to the poorer section of people in the study area, and the resources of Sundarbans are not easily accessible due to their socio-economic position among the others. Most of the *Mouals*' families are landless and they remain indebted largely to the *Mahajons* (money lender) who enjoy a monopoly over the resources collected by poor *Mouals*. The *Mahajons* provide cash loans at a very high interest rate to be paid in cash or the honey collected from the forest. The *Mouals* hire the boats −most important vehicle of honey collection from *Mahajons* on condition to sell their collection to them at a lower-than-normal price.

Giant Honey Bees of Sundarbans

The great deltaic Sundarbans is abundant with thousands of trees which help to produce a lot of nectar and pollen. For many thousands of years, this rich floral resource has been used by a species of bee called Giant Honey Bee (*Apis dorsata*) − the inch-and-a-half-long creatures migrate from mountains to the mangroves and build their nests relatively close to the ground, only 1 to 5 m high. An exceptional colony of giant honeybees can produce up to 30-40 kg of honey, although an individual colony more frequently possesses 5 to 10 kg.

Potential Areas of Beehives

Beehives are only found abundantly in some particular areas, and the distribution is not even throughout the whole Sundarbans forest area. Borigoalini range and its southwestern part in between the Raimangal and Malancho rivers in Bangladesh section of Sundarbans have the largest number of beehives.

Availability and Quality of Honey

The *Mouals* choose some definite months of the almanac and April (Bengali month- *Choitra* and *Boishakh*) is considered the most successful month to collect the best quality honey called *Padma Modhu*. The yellowish nectar honey of *Khalshi* (*Aegicers corniculatum*) flowers are known to be another quality variety of honey. In terms of the quantity of collection, plenty of *lal Modhu* (red honey) particularly from the *Goran* (*Ceriops decandra*) flowers is collected in the month of May and continues toward the end of June as millions and millions of the *Goran* flowers bloom during this period. Another reddish variety of honey also found in the forest from the flowers of *Garjon* (*Dipterocarpus* species.) and *Kankra* (*Bruguiera gymnorhiza*) trees.

The Beginning of Expedition

Before the commencement of monsoon, the *Mouals* enter the forest in search of giant honeybee colonies. They always follow the lunar calendar to get the best result of harvesting honey. Expedition for honey collection is designed on the basis of the commencement of lunar calendar. From their experience, they know that honeybees preserve nectar in their colony for a certain period of time and bees consume the nectar themselves during the new moon period. The honey collector uses small boat, as the tidal mangrove ecosystem possesses no roads connected with surrounding locality. Taking sufficient food, water and other necessities with them to sustain themselves during the arduous spent in the forest searching the honeybees and the *Mouals* roam many kilometers away from their home village and of course, spend many days (not less than two weeks).

The Formation of Hunting Groups

The ideal formation of a *Mouals* group is 10 to 12. But sometimes it varies from 8 to 12 on the availability of *Mouals* laborers. The *Sajoni* (an elderly expert team leader) selects team members from his close kin (affinal kin get priority) for the honey expedition and four or five members are coming from first kin. Others are expert neighbors.

Action in the Forest

The *Mouals* divide the forest into several territories and they have to traverse every inch of the forest land ignoring impenetrable mud and slush. Sometimes they have to swim across the creeks and canals at a high risk. The honeybees build their nest where sunlight cannot reach easily; that is, especially in the deep forest. In the deep forest area, the *Mouals* have to work within the access of dangerous wild animals like tigers, wild pigs, snakes, etc. With no roads or landmarks, it is very easy to get lost. Therefore, to ensure the connectivity of group members, a man stays on the boat and periodically blows a buffalo's horn to help orient the hunters When they find a hive of honeybees, they produce a kind of sound:*wa, wa* to seek the advice from *Sajoni*. A clear and predetermined division of labor existed among the workers and each member performs their duty under the control of *Sajon*. First of all, *Mouals* try to chase out the bees from the colony by using *kadu* (a stick with a bundle of dry leaves). The *Mouals* cut the anterior part of the colony by *hasua*(sharp edge) and leave behind the posterior section of the comb where the infant bees remain unaffected. In fact, the honey hunters return to a good honey spot a month later when the bees have rebuilt the comb and they will harvest the honey for a second time. The giant honeybee population could then be sustained, and the ecolosystem maintained. Generally, 7-10 colonies are harvested in day.

Conclusions and Policy Recommendations

As mentioned earlier, the *Mouals* are the permanent inhabitants within the forest area of Sundarbans, but they never enjoy the free exploitation of Sundarbans' resources according to their needs and desire. Most of the *Mouals*' families are landless and they remain indebted largely to the Mahajons (money lender) who enjoy a monopoly over the resources collected by poor *Mouals*. The Mahajons provide cash loans at a very high rate of interest which to be paid in cash or the belongings of honey collected from the forest. The *Mouals* hire the boats from Mahajons on condition to sell their

collection at a lower-than-normal price. The problem of merchandising of honey and absence of competitive price are the major difficulties and obstacles to receive the due share of arduous honey collection in the study area.. To reduce poverty, the *Mouals* should have better access to the forest round the year and the aforesaid barriers should be eliminated through proper policies and planning.

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FOOD INSECURITY AND DEPENDENCY OF CHEPANG COMMUNITIES ON WILD EDIBLE PLANTS

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Introduction

Chepangs are one of the most primitive communities of Nepal having their own language, culture and social characteristics. They inhabit the rugged terrains of the Mahabharat Hills of central Nepal along the Trisuli, Narayani and Rapti Rivers and in the catchments of their tributaries, covering the adjoining frontiers of Dhading, Makawanpur, Chitwan & Gorkha. Agriculture has been only recently introduced to the Chepangs (Hodgson 1848, Uprety 1967; Caughley *et al*. 1971).They were hunter-gatherer until recently. So there is considerable extent of interaction between the Chepangs and forests. Currently many efforts are being made to uplift their livelihoods by various agencies. In spite of these various efforts; their food security at household level has not been assured. They often do not have enough food to eat. It is common perception that Chepangs who have round-the-year food supplies are called 'rich.' Food culture among the Chepangs can be explained in relevance with ecosystem of the area (Gurung 1995, Manandhar 2002). They normally rely on cereal crops for about six months and for the other months, they have to depend on wild resources and work as labourers for subsistence. They collect many wild foods like *Gittha*, *Bhyakur*, *Bharlang*, *Sisnu,* etc. not as 'foods of famine', but as part of regular food.

This study was carried out in Chepang communities with the aim of documenting their wild and traditional food, food culture and dependency on wild food sources.

Methodology

Study area

The present study was carried out in two Village Development Committees (VDC), namely Dhusa and Jogimara, of Dhading District, Nepal. Both of the VDCs lie on the slope of the east-west oriented Mahabharat Range in central Nepal, which geologically is a part of the Lesser Himalaya. Many streams, like Jawangkhola, Hugdikhola and Mowakhola, had cut gorges here. The climate of this area is tropical at lower elevations up to 800m and subtropical above this elevation up to 1500m. The forest area has suffered from heavy disturbances. Forest area has been converted into exposed cultivated land (*Khoriya*). Dense forest area with original tree species is degraded. People dwelling in this area are mostly subsistence farmers. Agriculture, livestock raising, wild food gathering and wage laborer are their important economic activities. Maize is the main crop, supplemented by millet. They also grow their traditional foods like upland rice, sorghum and yams to supplement the maize. Other indigenous crops grown by them include foxtail millet (*Kaguno*), horse gram (*Gahat)*, rice bean (*Masyam)* and buckwheat (*Phapar**)***.

Methods

The data from the fields were collected by conducting five field visits between April and September in 2007. Two basic approaches were carried out to study the ethnobotany of wild and traditional foods of the Chepang communities. The first approach, known as the *artifact interview* technique, involved asking key respondents about the uses and methods of preparation of plants for various purposes, and the nature, availability and status of plants in the wild. The second approach,the *inventory*

interviewing technique, included exhibition of collected plant specimens and then obtaining information on the name and use of these plants by group discussion or interviews with the local people. During data collection respondents were selected from all groups of people, especially elderly people, traditional healers, women and educated persons. To ensure the consistency of data, inconsistent data were verified by informal group discussions and cross verification with knowledgeable persons. Beside the above approaches, Agrobiodiversity Conservation Blocks and Community Biodiversity Register (CBR) maintained by the local communities in support of UNDP/GEF/SGP through local NGO RIMS Nepal were observed. Plant specimens were collected and herbarium specimens were identified with the aid of standard taxonomic literatures (Noltie 1994, Zhengyi & Raven 2000).

Results and Discussion

Food calendar and food habit of Chepangs

Chepangs had lived a semi-nomadic life for generations. Today agriculture is the mainstay of their livelihoods. Due to the barren, rugged and infertile land, and primitive agricultural practices, productivity is very low. Therefore they do not get enough food. Most of the Chepangs normally can survive only for five to six months from the maize and millet they produced. Almost 50 percent of the cereal is fermented to make *Jand* which is an integral part of their food culture that eliminates wastage. For the rest of the year, they have to depend on food gathered from the wild, which is as important as agriculture, as well as by fishing, hunting and wages earned as laborers. Wild foods make up almost 40 percent of the Chepang's diet. They also play a major role in the survival strategies of Chepang communities, especially during food shortages. During the food deficit months, the majority of households collect wild food crops to meet their food requirements. Most of these are the tuber crops such as *Gittha*, *Bhyakur*, *Tarul* and *Bharlang**;*** and foliage of *Tanki, Koiralo, Niguro**;*** and stinging nettle. Curries prepared from bats, crabs, and larva and pupae of hornet and bees are other traditional foods of Chepangs.

Diversity of Dioscorea and ethnic affinity of Chepang

Tuberous root crops are of central importance to Chepangs. Chepangs possess a sound knowledge of the occurrence of roots and tubers. Wild yams (*Dioscorea* spp.*)* make a significant contribution to diets of Chepangs in Nepal. The species of *Dioscorea* collected from the wild by locals are given in Table1. Nepal has 14 species of *Dioscorea* reported (Press *et al.* 2000). Information on nine species (two species cultivated) of *Dioscorea* were collected from the comparatively small study area. Such high species diversity of *Dioscorea* is indication of their ethnic affinity with wild tubers.

Table 1. Species of *Dioscorea* collected from wild.

Scientific name	Chepang name	Nepali name
Dioscorea bulbifera	*Lac*	*Tito githa*
Dioscorea bulbifera	*Lac*	*Mitho githa*
Dioscorea deltoidea	*Kui goi*	*Kukur tarul*
Dioscorea hispida	*Hung*	*Bharlang*
Dioscorea pentaphylla	*Pas*	*Bhyakur*
Dioscorea Kamoonensis	*Gli*	*Tyaguna*
Dioscorea sp.	*Jyar*	*Choya*
Dioscorea belophylla	*Ban goi*	*Ban tarul*

Collection and mode of consumption

The severe food scarcity occurs during the period between April and June. During this period, they collect the tubers from forest. Generally people of all active age groups participate in collection, usually accompanied by children. Collective harvesting is not in practice. Disputes are very rare during collection. In most of the cases the collected tubers are sliced and boiled. Sometimes the sliced tubers are dried and grinded into powder to make a popular Nepali dish locally called *Dhindo*. A few of the tubers have medicinal value, which are being used by the local people for therapeutic purpose.

Local knowledge regarding use

Local people can precisely identify the wild plant which is close to our taxonomic distinction. Beside this, they have appreciable knowledge to process and consume even deadly poisonous species like *D. hispida*, which has sap which can cause skin irritation ..

Future Prospects

In addition to sustenance, the Chepangs depend upon the wild edibles for their spiritual, cultural and religious needs. They not only utilize but also conserve the life sustaining resources. Erosion of either of the diversity would greatly affect the human kind hence conservation of both the biological diversity and cultural diversity is crucial.. Moreover, the rich biodiversity and its relatively unexplored current status represent a big potential for bioprospecting for the modern world. It can benefit the local indigenous people for their efforts and pains they have taken to conserve the valuable resources and indigenous knowledge on their use that lead to the development of useful commercial products.

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THE ROLE OF *ÍBÚ ÓDÓ* SACRED POOLS IN PRESERVING RIPARIAN FOREST STRUCTURE AND DIVERSITY ALONG THE OUÈMÉ AND OKPARA RIVERS OF CENTRAL BENIN

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Introduction

In the center of the Ouèmé River Basin that spans the Republics of Benin, Togo, and Nigeria lays the Tchabé Kingdom. The legends of the origin of this kingdom and the communities that lie within it are many, but some tell of the people emerging from the waters of the Ouèmé and Okpara rivers. Even those who say people arrived overland reference historical events around specific points or pools in the river, Íbú ódó. These sacred pools are subject to rules that influence conservation practice, including the prohibition of fish poison, over fishing, pollution and the discouragement of grazing cattle and destructive burning. Respected not only by resident populations but also by migrants to the area, they may contribute to riparian forest and water conservation. This study examines the value of Íbú ódó sacred sites for riparian forest conservation and indirectly for flood and runoff buffering.

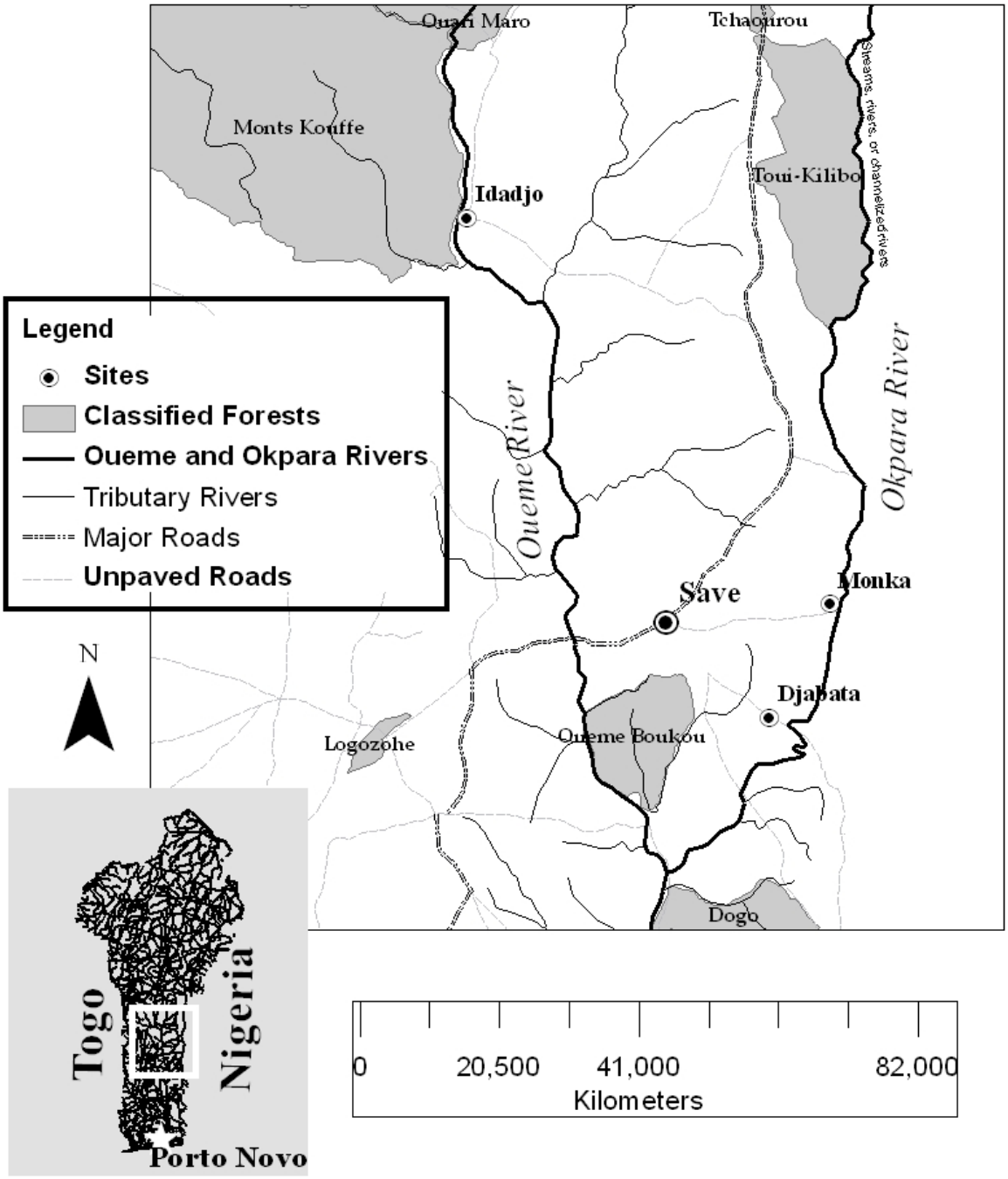
The vegetation on the borders of rivers and streams both filters nutrients and sediment from entering waterways and lowers flood damage, however these and other ecological functions are dependent on the width of the riparian zone, forest structure and species composition (Piegay & Bravard 1997). Because of its spatial heterogeneity and position, the riparian zone houses a high level of diversity, productivity and conductivity and is valued for its ecosystem services. Characteristics, such as the basal area, species composition and density of riparian vegetation increase its resistance capacity to floods, particularly in the more susceptible lower reaches (Piegay & Bravard 1997).

Like any forest, riparian zones are degraded by human activities, although they may be more resilient due to their productivity, diversity and connectivity (Naiman et al. 2005). Global disturbances to riparian vegetation include logging, fire, changes in flood regime, and encroaching farmland (Goetz et al. 2006) with consequences including a rise in silt loads, erratic flows, river cover decrease, temperature increase, river bank erosion and deterioration of aquatic vertebrate and invertebrate biota, which are more apparent in low-order streams compared to high-order rivers (Allan et al. 2002). Degradation returns full circle, negatively impacting the people benefiting from their diminishing services. For example, central Benin is susceptible to floods that result in loss of lives, homes, infrastructure, cropland and food (UNDHA 1985-2006).

Social values of riparian values are both economic, such as *Pentadesma butyracea,* in the case of Benin (Natta 2003) and spiritual (Ojo 1967). How has human use impacted riparian structure and diversity? And more poignantly, do the *Íbú ódó* sacred pools conserve the ecological function of their riparian location? This study assesses riparian forests near three villages and adjacent to four land uses - heavily human used, agricultural, sacred and state-protected - in central Benin for characteristics correlating with the riparian forest's ability to reduce the kinetic energy of floods - species composition, tree density, buffer width and tree age class - thus indirectly this study will assess the ability of these forests to buffer floods.

Three sites in the Ouèmé Basin, Idadjo, Monka and Djabata, were chosen for their ecological and cultural similarity, varying level of conservation and economic activity and presence of significant riparian forest and sacred sites (see Map). All study sites were in the *Soudano-Guinean* transition zone receiving between 1100 and 1200 mm annual precipitation in two rainy seasons peaking in June and September, the same vegetation gradient, the same ethno-linguistic group of Tchabe-Yoruba, and populations between 692 and 1128 (Adomou 2005, INSAE 2004). The State *Foret des Monts Kouffe,* managed by PAMF, is opposite Idadjo.

Map. Study area showing situation of three study sites in regional map.



Methodology

All trees with a breast height diameter greater than ten centimeters in three circular plots of four meter radiuses located along the riverbank, in the center and on the forest edge on 163 transects laid perpendicular to the river near the three village sites, were identified and measured at breast height. Transects were spaced semi-randomly 50 to 100 meters apart and they spanned areas adjacent to the villages, sacred sites and state-protected forests (*Foret Classé de Ouari Maro)*. Interviews with more than 30 elders, hunters, women and men in each site concerning values of the riparian forests, sacred forest, and land management situated the riparian forest inventory in a social context.

Results and Discussion

Sacred sites were found to be a significant element of conservation for Djabata, where there were both a large number of sacred sites and riparian forest diversity and density (Figure 1). Monka's position on the main Nigerian transport road and resulting accessibility for economic exploitation can explain its low richness whereas Djabata and Idadjo, which are much further from main roads, have higher species richness. In Idadjo, conservation has been promoted by a non-governmental organization, PAMPF, for the last decade. There was an observed effect due to adjacent land in classified forest, but little differentiation between forests adjacent to savannas of heavy human use, sacred forests, and agricultural land (Figure 2). Further work will continue to differentiate these classes to reveal if there is in fact no difference in the riparian vegetation.

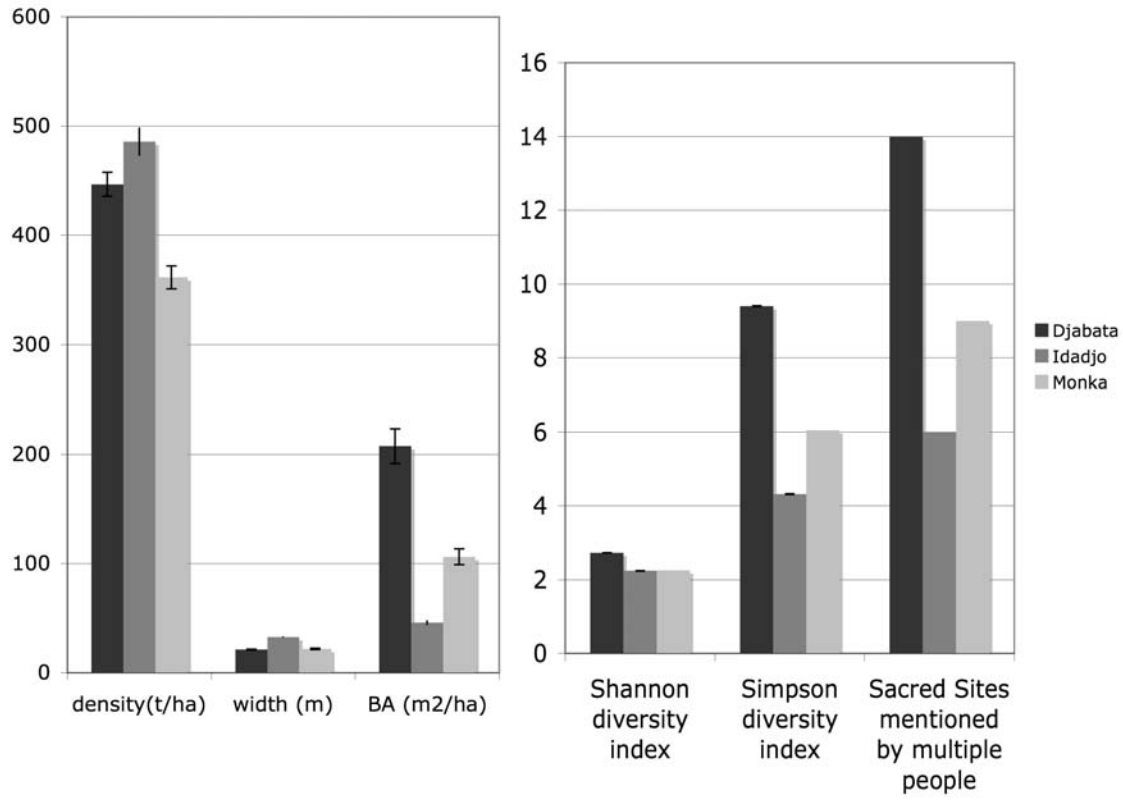


Figure 1. Density (trees per ha), riparian buffer width (m), average basal area (m^2), Shannon diversity index, Simpson diversity index, and the number of sacred sites mentioned by multiple people according to site. Error bars show one standard error.

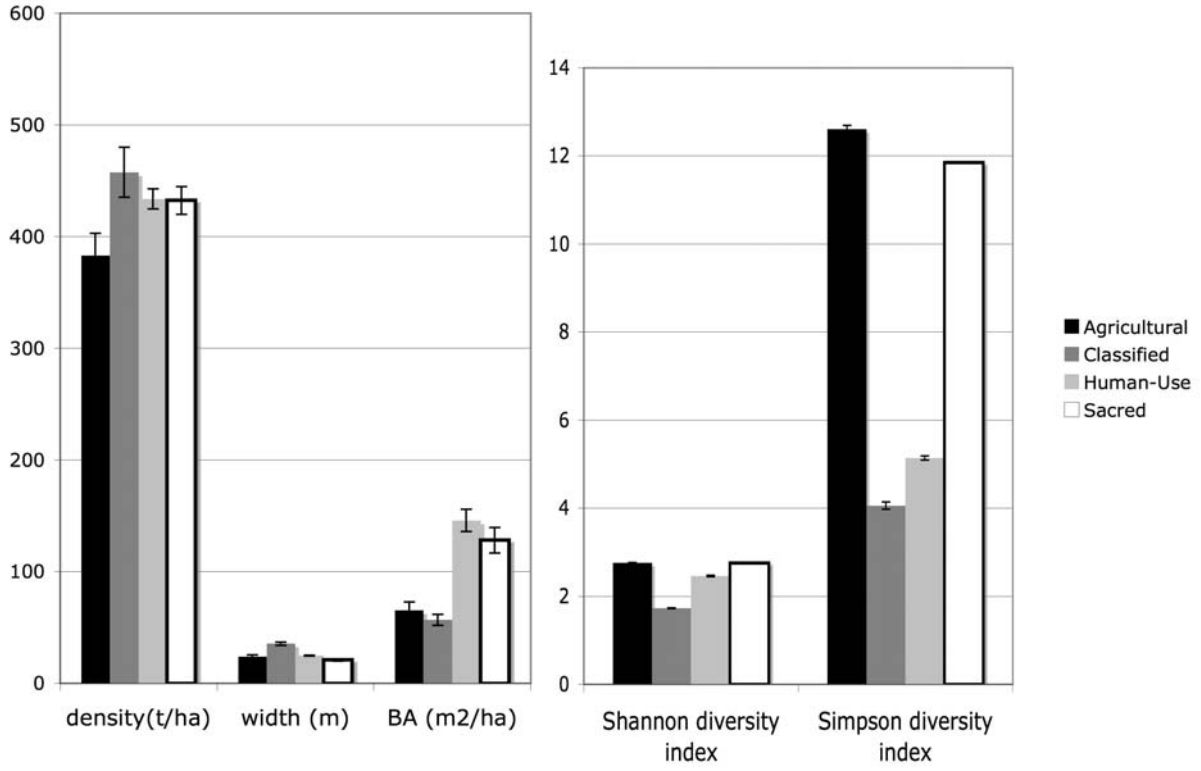


Figure 2. Density (trees per ha), riparian buffer width (m), average basal area (m^2), Shannon diversity index, and the Simpson diversity index according to adjacent land use. Error bars show one standard error.

The sacred pools occur where the river is particularly deep, the water gurgles, fishing is good, an historical event occurred, or where there is an interesting formation such as a suspended rock. Pools are home to spirits and upsetting them can have dire consequences including floods, drought, disease and infertility. Most are surrounded by taboos ranging from the manner one must behave or dress nearby to specific rules regarding what one can or cannot do. In most cases, people can make requests to the spirit for example to improve business, conceive a child, or make a good harvest. There is usually an elder who is responsible for organizing the sacrifices and communicating with each particular spirit.

Several taboos were identified that spoke specifically to the need to conserve these forests. However will these cultural and spiritual motivations for conservation stand up against the economic and demographic changes that are driving land use change? Major drivers of change of riparian vegetation include field expansion adjacent to riparian forest, timber harvests and cattle grazing. Migrants who come from northern Benin to farm in the central Oueme Basin are responsible for the majority of field expansion. The village king designates land far from the village for their use; often it is in the riskier, more fertile floodplain. *Ceiba pentandra*, *Diospyros mespilliformes and* the vulnerable *Albizia ferruginea* (IUCN 2007) are harvested for timber to be sold in southern Benin by outsiders who pay a nominal fee the local king. Cattle grazing has increased in the last decade as Peulh herders have been driven into the area due to regional droughts. They are perceived as the most severe threat to the landscape and water quality.

Climate change manifests in West Africa as less regular precipitation that results in frequent and severe floods and droughts (Ledger 1964). Respect for riparian forests may be instrumental in preventing potential disasters caused by the changing precipitation. When combined with the social assessment of the importance of these pools, this study provides the argument for respecting and reinforcing Íbú ódó. Encouraging respect for sacred sites is particularly crucial among younger

generations and migrants to the area. If Íbú ódó can be incorporated into a long lasting local conservation strategy, they could be instrumental in preventing destruction of the riparian forest.

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TRADITIONAL KNOWLEDGE ON UTILIZATION OF NATURAL RESOURCES AMONG THE PENAN COMMUNITIES IN NORTHERN SARAWAK, MALAYSIA

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Introduction

Traditional knowledge has been a subject of much interest and discussion in recent years, due to increasing realization of its importance in biodiversity conservation and potential contributions to research and biotechnology. In particular, the future well-being or even survival of mankind may depend on our present knowledge of numerous forest plant and even animal species for food and medicine. Due to the fast depletion of resources, changing lifestyles, urbanization and lack of interest among the younger generations, much of the knowledge is gradually being lost before it can be recorded. Realizing this, Sarawak has in recent years embarked on several studies to document numerous plants that possess ethnobotanical properties from the local communities (Christensen 2000, Chai 2007, Endela *et. al*. 2007).

The present study on the Penan community has been conducted under a transboundary biodiversity conservation project supported by the International Tropical Timber Organization (ITTO). The Penan are a minority tribe with a small population living in small villages at the periphery of the Pulong Tau National Park – the site of the ITTO project. The Penan are a minority tribe among 26 native communities in Sarawak, with a population of about 13,000 individuals. Their ancestors were nomads of the Bornean tropical rain forests that provided them with their every need. Today, even though all but about 500 have chosen to live a settled life, they are still to a large extent dependent on nature – their small villages are located close to the edge of the forests. Their long associations with nature have enabled them to learn and acquire a tremendous amount of knowledge on forest plants their uses.

Methodology

The survey depended heavily on the assistance of local experts to provide information on the plants and their uses. For documentation purposes, we only recorded information from plants that were encountered in the forest so that scientific identification could be made and voucher specimens collected for reference and herbarium records. The sources are natural forests- both primary and secondary - around the villages. The plants were categorized based on their uses.

Results

A diverse variety of species were recorded, with uses ranging from materials for construction, firewood, weapons and handicrafts, to food and herbal medicine. The categories of uses are summarized, in order of importance according to the Penan, as follows:

Food Plants

The women are responsible for both gathering and preparation of food and therefore have a better knowledge than the men. They regularly use 41 species of the plants for vegetables and fruits. The vegetables include leaves, shoots, stems, flowers and tubers. Starch from the palm *Eugeisonna utilis* is their most important staple food. Wild fruits make up an important diet during the fruiting seasons

especially among nomadic groups. Some examples are *Durio, Nephelium* and *Baccaurea*. To ensure continuous supply, the fruits are collected by climbing the trees. Settled villagers have begun to plant popular species in the gardens.

Firewood

Firewood is a must for cooking and ranks second in importance. Gathering firewood is also an important daily activity. Among the most popular of the 23 species used are *Lithocarpus, Chionanthus* and *Tristaniopsis*. The most sought after species are those that burn easily even when fresh.

Construction Materials

Timber and leaves for jungle huts and furniture are obtained from 16 species of forest plants. Preferred species for timber are *Agathis, Tristaniopsis* and *Cratoxylum*, while bamboo is also used. Palm leaves (from *Licuala* spp.) are the most popular roofing and walling materials. Rattan is used for tying.

Materials for Tools, Handicrafts and Instruments

Fifty nine species are used for various purposes such as blowpipes, knife sheaths and handles, mortars, hats, baskets, mats and musical instruments. Some examples are *Koompassia, Strychnos, Memecylon*, *Ixora*, bamboo, rattan and palm leaves.

Medicine

For the Penan, food and materials for daily needs and survival are a priority, while health care is probably of secondary concern. Nevertheless, the forest has a ready supply of herbal remedies - 77 species were recorded – to solve their health problems whenever the need arises. Common uses are for headache, sore eyes, sprains, diarrhoea, asthma, toothache and fever. Many species belong to the botanical families of Annonaceae, Fabaceae, and Menispermaceae.

Knowledge for Man's Future Needs

Two problems that the human societies are likely to encounter in the future will be food to feed our exploding populations and medicines to combat new diseases. Tropical rain forest contains potential genetic stocks for research on biotechnology for foods and health care. Food production is increasing being hampered by shortage of suitable land, over-use of chemical fertilizers and pesticides, and diseases and pests. Man will suffer from new diseases brought about by environmental pollution and unhealthy lifestyles. There will also be increasing demands for preventive medicines from natural sources as the people are becoming more health conscious (Chai 2000). By sharing their traditional knowledge, local communities such as the Penan can contribute immensely to research and biotechnology on which man's future needs and well being may depend.

Knowledge of the types of naturally occurring food and medicinal plants is vital to survival in the forest. The Penan's knowledge of nature conservation and sustainable resource management is noteworthy, as testified by the following quote from one community leader: "The forest is our supermarket; we collect only what we need". By sharing their knowledge, the Penan people can potentially contribute to research and development in food science, pharmaceutical and health products to satisfy man's increasing needs. Preservation of local knowledge comes with conservation. In this respect, Sarawak has made significant efforts through documentation and research, support to ITTO's call for sustainable management of tropical natural forests and biodiversity conservation.

Conclusions

There are altogether 24 native tribes in Sarawak that possess the traditional knowledge on an estimated 2,000 species of plants with ethnobotanical properties (Christensen 2000, Chai 2007, Endela *et. al*. 2007). The knowledge on medicinal plants for 16 of the 24 tribes has been documented (Chai 2007). While useful species are documented, appropriate steps must be taken to ensure their conservation and survival in the wild, as deforestation and habitat degradation are occurring at a rapid rate.

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PARTICIPATORY VEGETATION ANALYSIS IN A FOREST LANDSCAPE IN THE NILGIRI BIOSPHERE RESERVE

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Introduction

Deforestation and degradation of forest ecosystems in the tropics have received much attention at local and global levels due to their consequences - human poverty, loss of plant and animal genetic wealth, erosion of landscapes, siltation of water courses, drought and flooding (Singh 1988). A number of factors - mainly human and physical factors such as over-exploitation, fire, soil erosion, grazing and unscientific resource management - have been identified as contributors to the degradation process (Schreckenberg et al. 1990). As a result of these anthropogenic disturbances, mosaic landscapes composed of stages or phases of ecosystem degradation can be seen in many regions (Diaz 1996). Since the impact of these degradation processes is devastating both in socio-economic and ecological terms, management and rehabilitation of degraded forests should be seek to recover and maintain the basic structure and functions of ecological systems and at the same time help to provide the basic needs of the people (Anderson et. al. 1998). In addition, in a mosaic landscape with several landscape elements such as non-degraded forests, degraded forests, plantations, village ecosystems etc., there will be inter-linkages and interactions between these elements and also with those across the landscape. In this context, the conventional methods of vegetation analysis by forest managers or scientists alone is inadequate to develop and implement rehabilitation programmes. Thus, in the present study, an attempt has been made to undertake a participatory vegetation analysis in the forest landscape units around a tribal settlement in the Kerala part of Nilgiri Biosphere Reserve. The major goals of the participatory vegetation analysis were to assess the status of the forest patches in the landscape of the tribal community and to identify suitable forest management strategies which can be considered while implementing participatory forest management programmes.

Methodology

The study was undertaken in the Vaniampuzha forest tract ($11^{o}26.94'$-$11^{o}28.38'$N and $76^{o}12.49'$–$76^{o}14.22'$ E). Here, the Panians, a forest-dwelling tribal community, resides near the Vaniampuzha River. A participatory transect diagram was prepared for exploring the spatial pattern of foraging and gathering by the Panians. During the mapping process, five main types of habitats were recorded: relatively undisturbed evergreen forests (UEG), disturbed evergreen forests (DEG), relatively undisturbed moist deciduous forests (UMDF), moist deciduous forests disturbed due to collection of fire wood and non-wood forest products (DMDF), and forest patches within 100-200 m radius from the tribal settlement (TSF). In each habitat type, three replicate plots of 0.5 ha each were randomly selected and boundaries were marked. In each plot, density, basal area and girth class of distribution pattern of tree species were estimated by following standard field methods (Misra 1968). While the educated youths from the tribal settlements were involved in quantification and data processing, the elder citizens were involved in the tree identification processes. A meeting was conducted for the shared presentation of data by the team members (project staff and tribal youths), to discuss the key findings, and also to identify strategies for rehabilitation of degraded forests.

Results and Discussion

The density of tree seedlings and saplings (i.e., stem girths < 10.1 cm) was much greater in the relatively undisturbed evergreen forest than in the disturbed plots (14,467 *vs* 4,613 individuals ha^{-1}). On the other hand, mature tree (gbh >10.1 cm) density was more in disturbed plots (UEG: 975 individuals ha^{-1}, DEG: 1399 individuals ha^{-1}) due to presence of large numbers of individuals of light demanding species. In both plots, girth class distribution pattern of the tree component showed a

negative exponential curve with clear preponderance of stems in smaller girth classes (Figure 1). However, in the disturbed plots, such a girth class distribution is due to the better regeneration of species characteristic of secondary forests rather than those of primary forests.

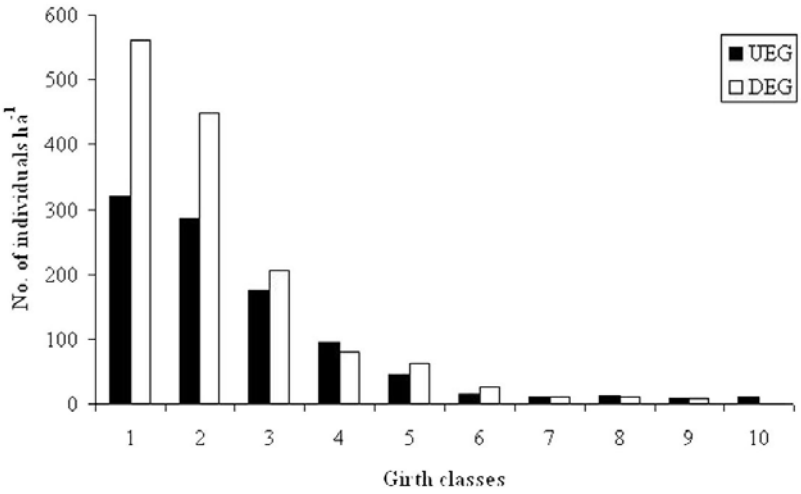

Figure 1. Girth class distribution of trees in the relatively undisturbed (UEG) and disturbed (DEG) evergreen forests in the Kerala part of Nilgiri Biosphere Reserve.

Girth classes: 1=10.1-30 cm, 2=30.1-60 cm, 3=60.1-90 cm, 4=90.1-120 cm, 5=120.1-150 cm, 6=150.1-180 cm, 7=180.1-210 cm, 8=210.1-240 cm, 9=240.1-270 cm and 10=270.1-300 cm.

Figure 1. Girth class distribution of trees in the relatively undisturbed (UEG) and disturbed (DEG) evergreen forests. Girth classes: **1**=10.1-30 cm, **2**= 30.1-60 cm, **3**=60.1- 90 cm, **4**= 90.1-120 cm, **5**=120.1- 150 cm, **6**=150.1-180 cm, **7**=180.1-210 cm, **8**=210.1-240 cm, **9**= 240.1-270 cm and **10**= 270.1- 300 cm

In moist deciduous forest, plots disturbed by firewood and NWFP collection did not show much variation from the undisturbed plots in terms of seedling/sapling density (UMDF: 4280 individuals ha^{-1}, DMDF: 4560 individuals ha^{-1}). However, the girths of most of the trees in this size class were less than 5 cm and thus recruitment to higher girth classes seemed to be very low as indicated by comparatively low densities of larger trees in the disturbed plots (UMDF: 389 individuals ha^{-1}, DMDF: 260 individuals ha^{-1}) .

Forests near the tribal settlement did not show significant difference from the relatively undisturbed moist deciduous forests in terms of tree density (TSF: 401 individuals ha^{-1}) although the total tree basal area was comparatively less. This suggested that the number of trees of higher girth classes is less near the tribal settlement, as also indicated in the girth class distribution pattern (Figure 2). Lower numbers of larger trees is an indication of intensive cutting of poles and small trees in the recent past.

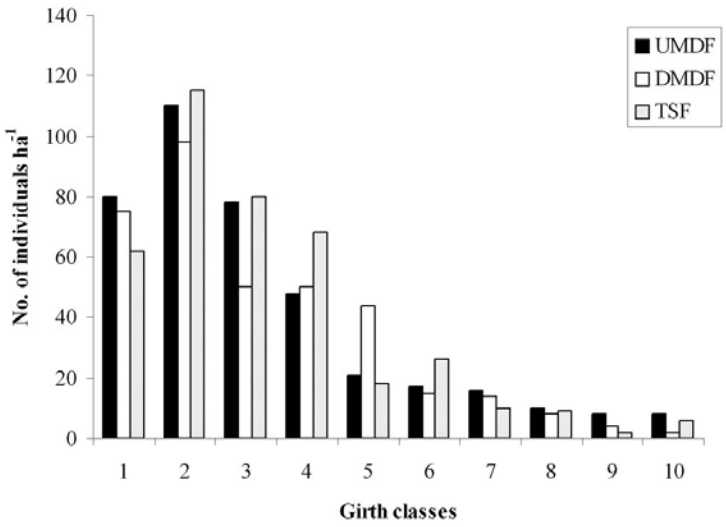

Figure 2. Girth class distribution of trees in the moist deciduous forests in the Kerala part of Nilgiri Biosphere Reserve. UMDF: Relatively undisturbed, DMDF: Disturbed, and TSF: Forest adjacent tribal settlement. Girth classes are as in Figure 1.

Figure 2. Girth class distribution of trees in the moist deciduous forests in the Kerala part of Nilgiri Biosphere Reserve.. UMDF: Relatively undisturbed, DMDF: Disturbed, and TSF: forest adjacent tribal settlement. Girth classes are as in Figure 1.

High dependence of the tribal people on the forests for their livelihood and survival is recognised as a key factor for the forest degradation. In fact, the dependence on forest for livelihood and survival also makes this tribal population the true stakeholder. Since the population in Vaniampuzha is homogenous in nature, there is a favourable situation to initiate participatory forest management. The option for rehabilitation therefore is to entrust and empower the tribal community to manage its own NWFP resources. In this context, during the meetings of shared presentation of vegetation analysis data, the stakeholder group identified following strategies for the rehabilitation of the degraded forest lands around them.

- Planting of medicinal plants such as *Asparagus racemosus*, *Cyclea peltata, Desmodium gangeticum*, *Coscinium fenestratum, Piper longum*, *Piper nigrum,* and *Pseudarthria viscida,* and wild varieties of fruit trees such as mango (*Mangifera indica*, particularly the Kannimanga variety), jackfruit (*Artocarpus heterophyllus*) and several other native species in the forests near the tribal settlements for providing immediate employment to the people but also to increase the resource base.
- Promotion of bee keeping around the tribal settlement to reduce the damage during honey collection from trees bearing honey combs in evergreen and moist deciduous forests.
- Effective management of lianas and climbers growing over the trees, particularly in the disturbed forest patches. However, *Acacia intsia* should be carefully managed, as it is an important medicinal plant being collected and sold by the local people.

The study clearly demonstrated that the participatory vegetation analysis is a useful tool for tapping the primary stakeholders' knowledge on the vegetation structure and composition, and for combining that knowledge with modern scientific expertise. Thus, this method of vegetation analysis should be regarded as an essential first step for the initiation of participatory forest management programmes.

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POVERTY AND BIODIVERSITY LOSS: RHETORIC AND REALITY

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A real conservation success is possible only when the complexity of both social (poverty reduction) and ecological (biodiversity conservation) goals is well addressed. To effectively combine both goals, it is important to understand how poverty triggers biodiversity loss and how exogenous forces such as market and policy incentives motivate poor or non-poor to further fuel extraction of natural resources. Mixed views are found about the role of poverty in environmental degradation and biodiversity loss (Adams et al. 2004). Scientists believe that poor and low income households rely on freely available forest resources to fulfill their needs. It is also argued that the impact of rich people is much higher than the poor counterparts, because the earlier consume more per capita and use the resources less judiciously compared to the later (WRI 2007). Various data and figures supporting these facts are presented. The data are primarily drawn from literatures, but personal visit and field observations are also accounted for.

Forests are the mainstay of livelihoods of vast majority of poor people throughout the developing world. Poverty, low income and food deficiency drive poor people to extract forest resources for various livelihoods needs. Slightly more than two-thirds and about one billion of the people worldwide live on less than 2 dollars and on 1 dollar a day, respectively (FAO 1999). More than three-fourths (78%) of those living on one dollar a day (extremely poor) live in Sub-Saharan Africa and South Asia, and more than 90% of them depend upon forest products. Similarly, the World Bank (Ahmed et al. 2007) reports that 162 million people live on less than 50 cents a day (ultra poor) and half a billion live on less than 75 cents a day. Most of ultra poor people also live in Sub-Saharan Africa (76%) and South Asia (12%). Geist and Lambin (2006) have summarized 16 poverty-related factors associated with ultimate causes of deforestation. They found 42% of all cases report poverty as being the underlying cause of deforestation.

At least 60% of tropical deforestation is caused by subsistence activities on a local level (FAO 1999). Some 10-15 millions hectare of forestland is destructed every year, largely in the South (80%) where most of the world's biological diversity and poor people live. Small farming families account for 2/3 of all deforestation. Close to 42% of the world's population depend upon firewood for primary energy sources (Figure 1B) and nearly 80% of them live in developing countries. Its consumption has increased by 250% since 1960s (Figure 1C). About 350 million poor people depend on forest for supplemental income and for the dwellers of forest-fringe areas its contribution is considerably high—22% of all population (WRI 2005). Some 3.5 billion people in developing countries rely on plant-based medicines for their primary health care (Figure 1D). Due to high population growth, the rate of overall pressure is increasing rapidly in developing countries. Nearly 145 people are added every minute on earth, of which 99% occurs in less-developing countries (Figure 1F). "A 10% increase in the population growth rate increases the rate of deforestation by 10.6%" (Rock 1996), implying that to meet food demand a large amount of new land must be converted into agriculture, mainly in Sub-Saharan Africa and Latin America. It is thus obvious that poverty contributes to deforestation and biodiversity loss.

Role of market and policy in degrading the environment and destroying biodiversity is more acute (Tables 1 & 2). Commercial logging is ranked as the biggest agent of tropical deforestation. International Tropical Timber Organization estimates less than 1% of logging in the tropics is truly sustainable. It is estimated that for every tree harvested, as many as 27 trees are killed or severely damaged (Verissimo et al. 1995). In South America, forests are cleared to plant forage and raise cattle (fueled by government subsidy), induced by beef hamburger demand in the West (Figure 2A; FAO 2006a). About 38% of deforestation during 1966-1990 in Brazil was done by large-scale cattle ranchers. Demand of palm oil (Figure 2B), rubber, timber, soya, and corn in international markets also

involves the similar fate, so does the demand of meat and body parts of some flagship species. Roads constructed in forests increase access to loggers, commercial hunters, and small farmers. International agencies fueled poor nation's forest destruction activities by introducing forest as a debt-payment option (FAO 1999). Above all, per capita consumption rate is significantly higher among developed countries compared to underdeveloped ones (WRI 2007; Table 1), suggesting that ecological footprint is higher among the former. "A 10% increase in income per capita increases deforestation by 49.5%" (Rock 1996). Majority of anthropogenic CO_2 emissions are also contributed by developed countries (WRI 2007).

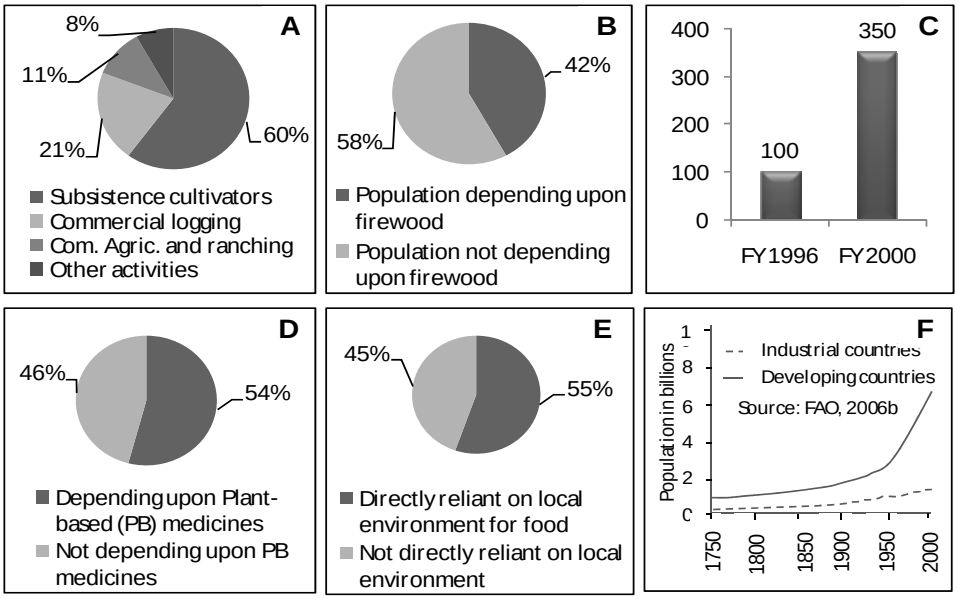

Figure 1. (A) Important causes of deforestation; (B) Total world population relying on firewood for primary energy sources; (C) Ratio of firewood consumption in 1996 and 2000; (D) World population relying on plant-based medicines; (E) Population relying on local environment for food; F: Population growth in industrial and developing countries (Sources: FAO, 1999, 2006b; WRI 2005)

Table 1. Comparison between high- and low-income countries (Adapted from WRI 2007)

Variables	High-income countries	Low-income countries
Total population	972 million	2.7 billion
Population density	31.1 people/km^2	83.4 people/km^2
Annual CO_2 emission per person	13 metric tons	1 metric ton
Annual per capital consumption of:		
Meat	94 kg	9kg
Water	970 m^3	556 m^3
Energy	5.4 tons of equivalent	0.5 tons equivalent

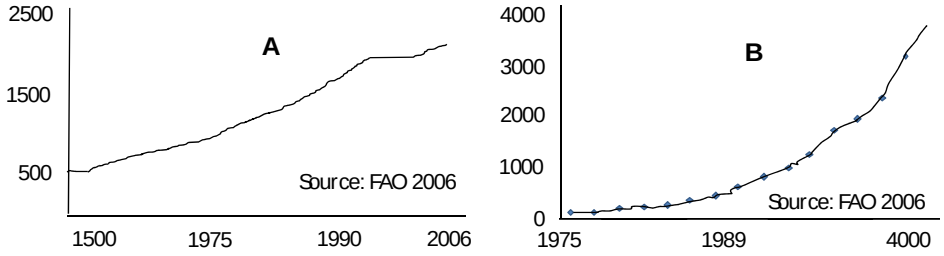

Figure 2. (A) Beef production in Central America ('000 mt); (B) Areas of palm oil plantation in Indonesia ('000ha)

Table 2. Manufacture of forest products in developing countries (2004); *Source*: FAO 2006b.

Product	Developing countries production (million)	Percentage of world population
Total wood production	2,019 cubic meters	59%
Wood fuel	1,599 cubic meters	90%
Sawn wood	99 cubic meters	24%
Wood-based panels	80 cubic meters	36%
Pulp for paper	46 tons	24%
Paper and paperboard	86 tons	26%

In summary, deforestation and biodiversity loss are attributable to several poverty-related factors. Yet, poverty-led destruction is small in scale; its impact is low and easily recoverable. Contrarily, deforestation induced by hamburger and timber demand, subsidy, debt payment, road-opening, consumption per capita, etc., is more intensive and precarious. Poverty-led deforestation is a compulsion, while non-poverty related deforestation is a motivation-driven coerce. Alternative sources of livelihoods need to be introduced for poor people, while making consumption pattern of rich people and industrial countries more judicious and sustainable. A combined efforts of informed, engaged, and cooperative global citizenry is necessary to meet this end. However, more quantitative studies are needed to understand how various endogenous and exogenous factors drive poor people to degrade forest and decline biological resources before we take any concrete initiative to curb these losses.

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TRADITIONAL KNOWLEDGE: INTELLECTUAL PROPERTY RIGHTS AND BENEFIT SHARING

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Forest-related traditional knowledge constitutes a major part of the heritage of indigenous peoples and local communities in developing countries. Such knowledge includes knowledge on the conservation of forest resources and the use of forest resources for food, medicines, household and community products as well cultural expressions. The paper highlights the key issues related to (1) preventing misappropriation of such traditional knowledge in the research, development and commercialisation of forest resources; and (2) ensuring that there is fair and equitable sharing of benefits with the holders of such knowledge.

Part 1 reviews the current international discussion and debate in the following arena: Convention on Biological Diversity, World Intellectual Property Organisation, the World Trade Organisation and UNESCO. A central issue is the limitations of current intellectual property rights regimes such as patents, copyrights, trademarks and geographical indications in effectively protecting the rights of holders of traditional knowledge. *Sui generis* frameworks for the protection of traditional knowledge are discussed as an option. The recent adoption of the United Nations Declaration on the Rights of Indigenous Peoples in September 2007 is significant, in particular Article 31:

> "*1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.*
>
> *2. In conjunction with indigenous peoples, States shall take effective measures to recognize and protect the exercise of these rights."*
>
> *In the current debate at the international level on , and some country experiences from developing countries*".

Part 2 of the paper highlights some experiences in developing countries in addressing the issues of intellectual property rights and benefit sharing related to forest resources and associated traditional knowledge.

THE IMPACT OF THE TIBETAN TRADITIONAL CULTURE ON ECOLOGICAL PROTECTION IN THE TIBETAN ALTIPLANO

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Introduction

Stressing the subjectivity of human and the objectiveness of nature has led the human race to choose an economic development model without considering the ecological benefits or ecological constraints. Many ecological problems have since then emerged, including global warming, increasing frequency of extreme climatic events, sharp decline of biodiversity, rapid desertification, etc. In light of all these, the rationality and sustainability of the economic behavior under the framework of industrial civilization are being re-examined (Lu Feng 2001). How to solve these problems? Redefining the relationship between human and nature is one of the critical issues towards solving these problems.

In the traditional economic model: land, labor, capital and technology constitute all the production factors. With the development of classical and new institute economics, institution is thought to be one of the production factors. In recent years, some studies had focused on the impact of the informal institute, including the culture, effect on the economic behavior and ecological behavior. The Tibetan traditional culture is an important influential factor for the stability and development of Tibet. From material, institutional and spiritual aspects, the Tibetan traditional culture molds the ecological and moral constraints of economic choices (Nan Wenyuan 2000, Zhao Zhen 2006).To some extent, this traditional culture has made steady headway and marked achievements in the ecological protection of Tibetan Altiplano (Nan Wenyuan 2001, Huarui Dongzhi 2003).

Methodology

The paper is based on field research conducted in the Lalu Wetland National Reserve in Lhala, NaMuCuo National Reserve. Fifty communities or rural areas in Lhala, Linzhi, Rikaze Region were surveyed using a set of questionnaires. Some traditional stories and taboos were documented from Lhala Municipal Administration of Environment, Lhala Municipal Administration of Tourism and The Tibet Museum.

Discussion and Conclusion

Three conclusions could be drawn from this study. First, the study had collected sufficient evidence that demonstrates that Tibetan traditional culture is an important influential factor in the ecological protection on the Tibetan Altiplano. The relationship between them is interactive and closely entwined. The Tibetan traditional culture has a unique philosophy about nature, life and the world, which has far-reaching impacts. Some ecological viewpoints have positive impacts on the ecological protection of the Tibetan Altiplano. Some religious taboos and traditional notions have made steady headway and marked achievements towards these.

Second, the Tibetan traditional culture contains three elements, such as material culture, spiritual culture, institutional culture, and the relationship among these elements of the Tibetan traditional culture is interacting and entwining. These independent elements jointly influence ecological protection on the Tibetan Altiplano. Material, institutional and spiritual elements constitute the Tibetan traditional culture.

These factors interact and constrain one another. At one time, the institutional culture and the spiritual culture are up to the material culture, while the institutional culture safeguards the material culture and the spiritual culture. The spiritual culture stands the highest level among the three kinds of culture. If the spiritual culture keeps in line with the material culture and the institutional culture, the spiritual culture will put forward the development of the other kinds of culture. Or, the spiritual culture will constrain the function of the other kinds of culture. Or worse, it will induce the reverse change of the other kinds of culture.

Third, because some contents of the Tibetan traditional knowledge is unscientific, the ecological concepts from the Tibetan traditional culture need abstracting and advancing. On the basis of modern technological knowledge and current ecological thought, the ecological concepts from the Tibetan traditional culture should be systematized and theorized. Regarding the relationship between humans and nature, most of the ecological concepts from the Tibetan traditional culture also stay the stage of upholding nature. From the partial, short time and static levels, the ecological concepts from the Tibetan traditional culture may bring the ecological effects of expectation, but from the whole, long time and dynamic levels, the culture concepts of the upholding nature may be invaded by the unsound economic development. To sum up, in order to protect the ecology and environment, we should use modern technology and scientific thought to abstract and enhance the ecological concepts from the Tibetan traditional culture.

Acknowledgment

During July and August in 2007, as an important member of the group named ‘The Green Long March in Tibetan Altiplano’ supported by the New Generation, whose leader was Xin Yongquan, I surveyed and investigated the state of ecology and environment protection in Tibet. During that time, especially, in the course of the investigation, Mr. Xin taught me how to make the questionnaire, how to conduct interviews with the rural people, and how to devise the line of the investigation. Also, I want give my billion thanks to Mr. Liu Jinlong for providing me with so good opportunity.

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TRADITIONAL KNOWLEDGE ON FIREWOOD AND FODDER VALUES CORRESPONDS TO SCIENTIFIC ASSESSMENT

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Introduction

Conversion of natural habitats through different land utilisation practices is the largest single cause of loss of biological diversity in Sikkim (Chettri & Sharma 2006). In the Sikkim Himalaya, 76% of the total resources needs are derived from natural as well as agro-forestry system due to free and easy access and simplicity in their use (Sundriyal & Sharma 1996, Chettri *et al.* 2002). The ever-increasing human and livestock populations in rural areas exerts immense pressure on forests and aggravate directly on livelihood by causing shortage of resources such as firewood and fodder. Utilisation of resources by selection of species with preference is widely practised in the Sikkim Himalaya (Rai *et al.* 2002, Chettri & Sharma 2006, Chettri & Sharma 2007). These practices have created immense pressure on the preferred species leading to change in species composition and distribution of these preferred species in natural forests (Chettri *et al.* 2002). However, farmers have made very little efforts in understanding the basis of such preferences of plant species. This paper is an attempt to compare the firewood and fodder quality of different plant species, with reference to people's ranking and their chemical properties.

Methodology

Study on firewood and fodder preferences by the local communities and their chemical properties were made in the Yuksam and Tshoka villages of west Sikkim. Matrix ranking tool of Participatory Rural Appraisal (PRA) was used for people's preference ranking on firewood and fodder species; and the chemical properties for firewood were tested by various methods used by Purohit & Nautiyal (1986), Rai *et al.* (2002), and Chettri & Sharma (2007). In addition, 25 fodder species were considered for another set of chemical analysis where crude protein (CP) and ether extraction (EE) of fodder species were estimated in dry matter basis following Anderson and Ingram (1993). Fodder value index was developed to assess the quality of fodder species with consideration of calorific value, dry matter (DM), crude protein (CP), ash content, and moisture content (MS), following suggested relationship by Saha *et al.* (1997). These attributes were then compared with the people's scores among the 17 widely used firewood species of the study area. Initially, Pearson's Correlation analysis was performed among the people's score, Fuelwood Value Index (FVI) and Fodder Value Index (FoVI), along with other wood attributes. A stepwise backward regression was also used for these two variables keeping the people's score as dependent variable and the wood attributes as independent variables to see the relationship between people's preference and wood and fodder characteristics.

Results

Baseline information gathered using Participatory Rural Appraisal (PRA) tools showed that the communities living at Yuksam-Dzongri trekking corridor use a wide variety of species for firewood and fodder. Due to the ability to recognise and the knowledge on quality of species, the communities living in these areas practised selective resource collection, and compensate with other species if the preferred species are not available. The research also revealed that the local people's preferences for firewood ($Y=3.30+0.48x$, $R= 0.48$, $P<0.05$) and fodder ($Y=0.74 +0.39x$, $R= 0.62$, $P<0.05$) were significantly related to the FVI and FoVI.

Firewood and fodder: preference ranking

Sixteen firewood and 23 fodder species were recorded as preferred species during the PRA session at Yuksam. *Quercus lieata and Q. lamellose* were ranked the highest firewood species followed by *Schima wallichii*, *Betula alnoides* and *Eurya acuminate* (Table 1). Among the 23 fodder species, 59%

were tree fodder, 14% shrubs, 18% herbs and 9% climbers. *Thysanolaena maxima* was the highest ranked fodder species followed by *Ficus nemoralis* and *Q. lamellosa*. However, *Prunus cerasoides* and *Artemisia vulgaris* were among the least preferred species.

Firewood and fodder: Chemical properties

Among the 16 widely used woody tree species, rhododendrons were found with high calorific value and the FVI. Among them, *Rhododendron arboreum* showed the highest value followed *by Q. lamellose* and the least was recorded from *Alnus nepalensis* and *Litsea elongate.* Among the fodder species, *Thysanolaena maxima* showed the highest calorific values as well as the FoVI (Table 2). The other attributes also varied among the species corresponding to the FVI and FoVI. Interestingly stepwise regression supported the rationale behind people's score, as the firewood and fodder attributes are strongly correlated to the basis of preferences. This analysis clarified that energy value; density, moisture and ash contents were the key attributes for people's preference for firewood. However, it revealed that moisture content is of least importance to the people's choice. Similarly, the calorific value, dry matter and nitrogen content were the most important distinguishing factor for people's preference.

Discussion

Chemical properties of plants provide important information about their values (Purohit & Nautiyal 1986). It is therefore, important to assess the quality as per preference. For ideal firewood, high heat of combustion, high density, low ash content, and other combustion properties are the most desirable (Purohit & Nautiyal 1986). Among firewood species *Rhododendron* spp. and *Quercus* spp. were found to have high FVI which corresponded with the preference ranking scores. Similar report has been reported from Central Himalaya (Purohit & Nautiyal 1986). Nitrogen contents in almost all the lower ranking species were high. Higher nitrogen content produces more nitrogen oxides from the wood during combustion thus reducing the acceptability as good firewood (Purohit & Nautiyal 1986). Due to low ash content, high density and low moisture*, R. arboreum* was found to be the most desirable firewood with the highest FVI value as discussed by Chettri & Sharma (2006).

Among the enlisted species for fodder, all the three high ranked species were tree fodders. Shrubs, herbs and climbers showed comparatively low ranking for preference as also reported by Bajracharya *et al*. (1985). This may attribute to the seasonal availability of these species. *Thysanolaena maxima*, *Ficus nemoralis, Quercus lamellose, Imperata cylindrica* and *Saurauia napaulensis* were found to be the highest ranking fodders with comparatively high calorific value and other characteristic supporting the earlier studies of Saha et al. (1997) and Ranjhan (1977). In spite of high calorific value, many shrubs and herbs species have low feed value. This may be due to low DM. The estimated data revealed that the quality of fodder does not depend solely on one variable like calorific value nor the protein content but the combination of such properties results in deciding the high feed value of fodder, which corresponded with the report by Bajracharya *et al*. (1985). The attribute to ecological factors including soil and climate, also influences the chemical composition of fodder plant (Wolf 1972). Most of the tree species ranked high as fodder by the local community have more than 30% dry matter and less than 10% ash as suggested by Pandey (1975) and Ranjhan (1977), suggesting that the local knowledge of preference are applicable for the selection of better fodder. Overall, the chemical properties and preference rank agreement seems to be applicable for many of the tree fodders but vary with herbs, shrubs and climber.

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Table 1. Firewood Value Index (FVI) and other wood attributes of the firewood species enlisted from Yuksam-Dzongri trekking corridor, west Sikkim.

Sl No	Latin and local names in parenthesis	People's scores	Energy value (kJ/g)	Moisture content (%)	Density (g/cm^2)	Ash content (%)	Biomass/ ash ratio	FVI
1	*Rhododendron arboreum* (Lali guras)	6	19.72	25	0.69	0.24	417	22678
2	*Quercus lamellose* (Bajrant)	10	20.47	39	0.72	0.23	435	16431
3	*Rhododendron falconeri* (Korling)	4	19.30	49	0.65	0.25	400	10241
4	*Schima wallichii* (Chilaune)	9	19.41	59	0.76	0.22	455	11365
5	*Quercus lineata* (Phalant)	11	20.21	47	0.69	0.28	357	10596
6	*Prunus cerasoides* (Panyun)	5	17.15	44	0.73	0.27	370	10538
7	*Rhododendron barbatum* (Lal chimal)	6	17.91	47	0.75	0.29	345	9855
8	*Castanopsis hystrix* (Jat katus)	4	18.78	43	0.79	0.38	263	9080
9	*Prunus nepualensis* (Arupate)	2	18.46	47	0.76	0.33	303	9046
10	*Beilschmiedia sikkimensis* (Tarsing)	5	15.79	41	0.58	0.25	400	8935
11	*Acer oblongum* (Phirphire)	4	17.78	35	0.67	0.63	159	5403
12	*Betula alnoides* (Saur)	8	18.91	56	0.67	0.47	213	4814
13	*Eurya acuminata* (Jhiguni)	8	16.75	50	0.72	0.67	149	3600
14	*Symplocos ramosissima* (Kharane)	1	15.24	76	0.67	1.3	77	1033
15	*Alnus nepalensis* (Uttis)	2	16.25	66	0.45	1.6	63	692
16	*Litsaea elongata* (Kali pahenli)	2	13.59	58	0.35	1.83	55	448

Table 2. Calorific value and nutrient composition of 23 widely used fodder species of Yuksam-Dzongri trekking corridor.

Sl No	Species (local name)	People's scores	Calorific value (kJ/g)	Ash free Calorific value (kJ/g)	Dry matter (%)	Ash (%)	N (%)	CP (%)	FoVI
1	*Thysanolaena maxima* (Amliso)	22	22.04	21.99	38	8.9	2.54	15.8	18.18
2	*Ficus nemoralis* (Dudhilo)	20	20.92	22.42	30	11.2	2.24	14	16.81
3	*Quercus lamellosa* (Bajrant)	19	20.23	17.06	65	6.4	1.24	7.7	15.38
4	*Imperata cylindrica* (Seeru)	18	18.92	20.45	46.6	7.5	1.36	8.5	13.02
5	*Saurauia napaulensis* (Gagoon)	17	18.23	20.14	18.9	9.5	2.09	13.1	12.19
6	*Rhaphidophora sp.* (Kanchirna)	16	18.17	22.21	24	12.6	1.69	10.6	11.8
7	*Litsaea elongata* (Pahenli)	17	19.35	20.69	42.2	6.5	2.25	14.1	11.49
8	*Ficus roxburghii* (Nebaro)	20	18.6	19.53	33.3	4.8	2.35	14.7	10.66
9	*Arundanaria hookeriana* (Parang)	11	19.85	22.15	48	5.9	1.38	8.6	10.55
10	*Eragrostis tenella* (Banso)	11	17.67	21.42	15.8	17.5	1.46	9.12	9.65
11	*Cauteleya spicata* (Pani saro)	8	18.04	20.31	21.2	11.2	1.78	11.1	7.81
12	*Bambusa nutans* (Malla bans)	9	19.23	21.06	33.8	8.7	1.42	8.87	6.75
13	*Crysopogon gryllus* (Salimo)	9	17.66	24.68	40	8.2	1.41	8.8	6.09
14	*Ichnocarpus frutecens* (Dudhe lahara)	8	18.86	19.6	35.5	3.8	1.88	11.7	6.04
15	*Arundanaria racemosa* (Mallingo)	9	18.86	22.05	56.7	14.5	1.37	8.6	5.47
16	*Brassaiopsis mitis* (Phutta)	8	16.23	21.32	27.9	5.1	1.38	8.6	4.96
17	*Pantapanax leschenaultii* (Chinde)	5	19.11	20.64	36.1	7.4	1.36	8.5	4.65
18	*Solanum aculeatissum* (Bhede ghans)	6	18.61	20.63	38.3	9.8	1.26	7.9	3.49
19	*Aconogonum molle* (Thotne)	9	19.98	22.6	32.5	11.6	1.78	11.1	3.46
20	*Prunus cerasoides* (Panyun)	3	20.04	22.59	32.3	11.3	1.69	10.6	3.36
21	*Artemisia vulgaris* (Tetey pattey)	2	17.17	19.33	24.1	11.2	1.7	10.6	1.94
22	*Leucanthus pedicularis* (Sanu gagleto)	4	14.73	18.69	14.5	21.2	1.94	12.13	1.54
23	*Elastostemma sessile* (Thulo gagleto)	5	15.73	17.11	12.7	8.1	1.56	9.7	1.03

ENVISIONING ECOLOGICAL AND CULTURAL PLACE FOR SUSTAINABLE LIVELIHOODS: PRE-STEP TO THE REALIZATION OF TRADITIONAL FOREST-RELATED KNOWLEDGE

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Introduction

In Korea where Traditional Forest-related Knowledge (TFRK) has become quite rare or has not become conspicuous even among the people who have retained it, it is not easy to tell 'how to use'.

The first step to discuss might be ' how to revitalize or activate' TFRK in people's notion of forest, in their experience of forest.

By evoking their forest experience, access to the consciousness of TFRK might be possible. In some local societies of Korea, scholars and local elites are planning to define the composition of forest, other ecosystems, cultural relics and practices as an 'invented place of livings' including human beings and societies. They have ideational reliance and imagination on local people's livelihoods and traditional wisdom/knowledge of everyday ecology.

In some First Nations in Canada, the practices of 'cultural management' are emerging in which forest and other spaces are defined as the places for all livings and for human experience. The cultural management is an execution of the aboriginal right which is based on the people's notion of place and all beings living there.

Though the historical, cultural and environmental contexts of the two cases are quite different, they tell the same issues. The relationships between man and place, relationships between the beings in the place, are important components constructing people's notion of the natural surroundings in present situation.

Making cultural values of place and all livings: Korean southwestern coasts

The southern and southwestern Korean coasts and islands have rich biological diversity. Representative vegetation is composed of evergreen broad-leaved woods and needle-leaved pines. Camellia japonica, Magnolia hypoleuca, and other great variety of trees make these areas as ecologically highlighted niches for the trees and surrounding livings.

Temples, village forests, village shrines have been the functional places of preserving the biodiversity. People put stones in the forest as marks to express their aspiration. The stone mounds become cultural landscape and sacred sites in the forest. They are mainly made in the natural cites in harmony with ecological density.

The menhirs are religious protector of villages or Buddhist temples. They are the landmarks of villagers' communal identity or temple territory. They represent cultural place with tangible marking in the natural surrounding and spiritual protection of natural and human place.

All these sites have been formed in the scheme of 'cultural construction of nature'. It means that they have been formed to put meanings and cultural values of human and space in the natural world.

Mihwang Buddhist Temple (established in AD 749) at the southwestern end of Korean peninsula is another example. It is located among the coastal mountains with evergreen broad-leaved trees, facing tidal flats and the Dadohae archipelago.

In Korea Mihwang temple is characterized as an epistemological and real linkage from an end of Korean spinal mountains to the ocean and islands. Here, people's notion of mountains, oceans, and other places, contributes to the preservation and sustainable use of these places.

Nowadays some villagers, local elites, and cultural NGOs, have tried to get concrete knowledge of the mountain Dalma surrounding the temple. Local elites have produced cultural and ecological maps, and plant lists. Villagers have made small performances, mountain temple concerts combined with traditional Buddhist rituals. All of these facts were well known in Korea with their message of living beings (saengmyoung) and spirituality.

Next year, Mihwang temple and villagers will launch religious tour from the Mihwang temple forest to the Dadohae archipelago. It is a revitalization or invention of old tradition of making trip from the temple to the islands. But presently it has new meaning. That is, people are reinterpreting ecological meaning of Buddhism and animating power of people’s performance traveling the forests, oceans and islands.

The theme is protection and evoking lively powers vitalizing all living beings by their visit. People are envisioning the symbolic power of making community among all beings including human beings, forests, earth and seas, linked by the trip. This is the people’s way of learning ecological and cultural places and things. Way of learning other people making interactions with them. Knowledge will be formed through this cultural pilgrimage.

Jang, Jin-Sook, 40 years old villager nearby the temple, has served the religious, cultural events of the temple. As she grows up in the forest she has got the ways of seeing and ways of feeling of the forest as an animated living world. She is planning to perform the storytelling of the forest, the intimate relations between forest and human. As a traditional performer she is planning to reinvent Buddhist traditional dance 'Jakbub' distributing the message of forest's giving birth to all living beings and making people's livelihoods. ‘Sikdangjakbup', a kind of food ceremony will be reinterpreted as life-giving to all living beings in the forest.

Oneness, respect and spirituality: First Nations in Canada

In the First Nations of Pacific coasts and islands, British Columbia, Canada, people frequently say that 'ocean is mountain'. The sentence tells a way of their interpretation of their ecological knowledge based on their subsistence.

Young salmons hatched in the small fresh watersheds roam for a while in the fresh water, being brought up by forest nourishment. After a while they proceed into the ocean heading for the far Pacific. When they return four years after birth, they go up to the spawning grounds in the forest. They are dead serving themselves as food for the bears, eagles and other living beings.

Also they serve as nourishing source for cedar, fir, bracken, moss, berries and various temperate rain forest plants on which animals and human beings depend for their living.

Human beings appropriate salmon fishes and plants in this ecological relation. First Nation people express this relation with abstract notion, 'ocean is mountain', defining all habitats as related by the notion 'oneness'.

Chehalis Indian Band people at the Harrison River in the mainland have some words of this abstract notion 'oneness'.

'Snowiyith' means one law of everything. At the same time it means 'respect'.

All beings are with 'shxweli' (spirit) and personified. Plants are 'plant people', salmons are 'salmon people'.

All beings are respected and regarded as spiritual people. So there is a great linkage with spirituality under the umbrella of oneness. Forestry, fishery and other gathering activities are managed by the notion of this communal, spiritual relationship.

Their economy depends upon the forestry (logging) and fishery. But they have protested against some cases of outside corporate logging, for the corporations transgress the spiritual relationships with a mountain area.

This area is the place where people's ritual gears have been put on the trees. In the 'Sasquatch' passes, there are the burial mounds of ancestors. This mountain area is the place where so many natural beings are believed as transformed ones from previous ones and where many people's totemic animals are living.

Transformation is one of the essential modes of existence. The knowledge about natural beings includes the story of transformation. So the knowledge is composed of multi-layers of time and existence. The transformation also includes the change of living places.

The protest against outside corporate logging in the mountain area, the negotiation with corporations on the other forests and the logging by the Chehalis Band people are all tied to the issues of aboriginal rights. Knowledge about the existence of the place and natural beings, spiritual, ancestral connection with them, reside in the aboriginal rights. They call the utilization of these notions as 'cultural management'.

This utilization is based upon the spatial concept, that is, their 'place' (territory) where all beings are linked together. These cases tell that, over the economic rationality or practical reason, people make their place 'meaningful'. These activities are adding cultural values to the natural world, forming cultural ecology, where the supernatural world joins with the cultural and ecological world.

Next step toward TFRK

In Korean and First Nation cases, people, living beings and place are related. The relational thinking might be a fundamental scheme in which formation of traditional knowledge occurs.

People are trying to interpret traditional meanings, reinterpret them in this present society or reinvent them envisioning the relational world. In the First Nations, present beings are transformed ones from other ones in different times and sometimes in different places. Transformation is a kind of relation between different beings, times and places.

The next step will be study of the process of traditional knowledge realized and transmitted in the world of holistic, relational thinking, which includes both practical reasoning and symbolic or emotional dimension. Forest is a place of livings not only as a practical resources but as a symbolic one which make people quest for meanings to sustain their livelihoods in this holistic, relational place.

SONGGYE, KOREA'S TRADITIONAL KNOWLEDGE FOR SUSTAINABLE FOREST MANAGEMENT

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Introduction

The collection of firewood for energy and fodder for domestic animals was the most important activity of farmers during the *Choson* Dynasty (1392-1910) in pre-modern Korea, similar to farmers of other parts of the world. As Korea is located in a climatic zone with long cold winters, securing firewood was critical for people's survival. Firewood and fodder, along with building and coffin materials, were obtained from nearby forests around the village.. Under national policies during the early period of the dynasty, landless peasant farmers were given free access to forest resources for securing firewood and fodder. However, the landless rights to these open access resources was seriously threatened in the later period of the dynasty by the royal family and elite class' privatization and appropriation of free access resources(Bae et al. 2002). Such misuse of forests by the powerful and elite class quickly spread through Korea by the 16th century. Especially after the two invasions by Japan and China, power groups such as high-ranking government officials and the army led such illegal privatization of forests. These groups exercised their power and claimed exclusive rights to the use of forest resources and prohibited others' access to these resources. In rural areas, local governments issued certificates of private ownership of the forest land to these power groups and fenced off the forests so that others could not access these resources. Villagers around the forest were stripped of most of their traditional rights to use forest resources. This growing privatization and appropriation of open access forests by royal families and powerful elite class forced the villagers to seek measures to secure their own raw materials from the forests.

Organization and operation of *Songgye*

*Songgy*e was formed by villagers to secure communal use of the forests around their villages. *Songgye* set up its own rules and regulations and formed a corresponding organization with its own operational guidelines. *Songgye* rules describe how to appoint a board of directors, who were from the membership of *Songgye*, how to be a member, how to tend and utilize various forest resources, and how to manage the assets accumulated by the *Songgye* operation (Park 2000). Normally the eldest in the village was elected to represent *Songgye* and he appointed today's equivalents of general secretary, treasurer, and auditor, who actually ran the organization and its various operations. Normally, membership was compulsory so that every household residing in the village was a member. Those who moved in from other villages or established a new household by marriage would become members by paying extra dues (Kang 2002). All members would voluntarily pay a forest tax every year.

The rules and regulations of *Songgye* also specified related issues on various forest management activities such as forest patrol and policing, prevention and control of forest fire, pine logging, shifting cultivation, collecting fodder, and building ancestral tombs. In the case of forest policing, each village around a forest under *Songgye* was responsible to patrol a section of forests once every spring and fall, and made extra patrols whenever necessary (Park 2001). *Songgye* not only assigned the area to be patrolled but also specified related duties while on patrol. An emergency contact network was formed to mobilize necessary manpower for combating forest fires. Entering into the forest was prohibited when the risk of fire was high. Those who violated this rule were subject to punishment and fines. When selling valuable pine trees, stumpage price was specified according to tree size. When the log was purchased by non-villagers, a differential fee was imposed. Shifting cultivation within *Songgye* forests was allowed only in limited areas on the condition of prevention of illegal logging and activities prone to forest fire. When an ancestral tomb had to be located within *Songgye* forest, members were required to pay certain fees and prohibited logging in surrounding areas. *Songgye* assigned

designated forest areas to each village for collecting fodder and for conservation purposes while prohibiting non-villagers from collecting in these areas.

Area of *Songgye* forests

Acquisition of forest land is a prerequisite to form a *Songgye*. Villagers collectively purchased a forested mountain, or secured the access to forest through government lease. One study shows that the area of the forest under *Songgye* system varied from 1 ha to 500 ha depending upon the type. In case the forest was owned independently or by one village, *Songgye* forest was rarely larger than 50 ha whereas those *Songgye* joined by more than 5 villages could easily be larger than 100 ha. Some largest joint *Songgye* exceeded 500 ha (Kang 2002).

Implications of *Songgye* for sustainable forest management

The values of Songgye which continued over the past 300 years can be reviewed from the following forest management point of view. First, voluntary public participation sustainable forest management, and second, social impacts of the privatization of forest land during the Choson Dynasty.

Voluntary public participation for sustainable forest management

Songgye was invented as an institution to meet the needs of the people. *Songgye* was a forest policy tool to allow landless class securing access to forest resources in return to systematic protection of the forests from illegal logging and clearing. The forests under *Songgye* system were reportedly well protected with sizable timber according to one study conducted during the Japanese colonization period (Park 2000). This supports the view that voluntary forest management by local community is effective for forest utilization and protection. From the perspective of modern forest management, *Songgye* managed the local forests, what are today called community forests. *Songgye* set up voluntary rules and regulations and each member donated efforts for sustainable forest management in the forms of money and labor. *Songgye* can be interpreted as an institution for sustainability, because it allocated sustainable amount of timber for logging each year to avoid depletion of timber supply. It is worthwhile to revisit the aspect of *Songgye* by which property rights to certain forested area were granted by national government. In addition, national government empowered *Songgye* to enforce forest use regulations. *Songgye* in many ways is the precursor of community based forest management approaches recently developed in many western countries. Korean ancestors not only invented but practiced sustainable forest management long before the term was coined (Chun 1997).

Social impacts of Songgye

What we can learn from *Songgye* is that the social impact of privatization of forests can be enormous. The forests in *Choson* Dynasty were open access resources except for designated preserved forests. *Choson* Dynasty government kept certain forests from public use for supplying timber for shipbuilding, construction, and other uses. This forest land tenure system collapsed after the invasions by Japan and China. Rapid privatization was introduced in the 18th century. As a result, the forest area accessible to the general public was sharply reduced. *Songgye*, as an institution for sustainability, was introduced in the midst of rapid social and economic transition of forest tenure systems. The rationale of *Songgye* as an institution for sustainability implies a lot for modern day forest tenure system (KFS 1997).

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DIVERSITY AND ETHNOZOOLOGICAL STUDY OF SMALL MAMMALS IN VILLAGES SURROUNDING THE PENDJARI BIOSPHERE RESERVE IN NORTHERN BENIN

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Introduction

Research on conservation of wildlife in reserves in Benin has focused on large mammals due to their appeal for hunting, tourism and related uses (Akpona 2004). Consequently, vigorous surveillance measures developed in protected areas increasingly discourage poaching of large animals. Hunting of small mammals has increased due to their ease of transport (because of their size) without being stopped by park guards (Lamarque 2004). However, few studies have assessed the diversity of small mammals targeted for hunting and their importance for communities bordering the Pendjari Biosphere Reserve (PBR). Thus, the lack of scientific data on the utility of the small mammals for the survival of the riverian populations of the BRP limits the actions of durable conservation. This study aims to fill this information gap by determining the specific richness of small mammal species in the villages surrounding the PBR, assessing the relationship between the human and small mammal populations that either support or threaten their conservation, and finally evaluates the different technical traps of small mammal species in their habitat by the villages sampled.

Methods

This study was conducted from August through October 2007 at the PBR. It is located in the Atakora department of north-western Benin, at latitudes of $10^{o}30'$ and $11^{o}30'$ North and the longitudes of $0^{o}50'$ and $2^{o}00'$ East. For the purposes of this study, small mammals included all species having at least the size of a grass-cutter (*Thryonomys swinderianus*) (overall length: 40-80 cm; Weight: 7 to 10 kg) were chosen according to the small mammal definition of Lamotte and Bourlière (1975) which says that this fauna category includes all mammals whose weight or size is less than the hare (3-5 Kg) or the marmot (6-10 Kg). Twelve (12) villages of three socio-cultural groups (Wama, Gourmantché, Byali) were considered and thirty people (hunters, farmers, and park guards) were surveyed in each village. Local perception on the diversity of small mammal species was determined by the formation of focus groups in each village and by using the list and picture of assumed species in this study site. This list was established by using several wildlife guides (Heymans 1985, Kingdon 1995, De Visser *et al*. 2001). The analytic method (Prance 1991) following whether the consensus is raised (frequency of nomination raised), whether a species exists and is well known by the populations was investigated. The small mammal trapping techniques across the twelve villages was subjected to Correspondence Factorial Analysis (CFA) by using SASv8.2 software. Also the small mammals species determine by local perception were regrouped in 4 classes by realizing the numerous classification analysis. We calculated the percentage of each variable such as the favourite species in the feeding, medicine, and totem species.

Results and Discussion

Diversity and observation period of small mammal according to the local populations' perception

A total of 43 species of small mammals were inventoried in the sampled villages surrounding BRP. The dendrogram analysis (Fig. 1) shows that the grouping of small mammals in 4 classes (A: species observed between 0 and 1 year; B: species observed between 1 and 5 years; C: species observed between 5 and 10 years; and D: species not observed in the last 10 years) generate a value of R^2= 0.772. This indicates that the quarter of the relative information to the species is lost after this regrouping. However, this retained R^2 value is sufficient to clear the big tendencies as for the description of the four classes. The species which compose each are:

A: *Xerus erythropus* (e_{19}); *Thryonomys swinderianus* (e_{21}) ; *Cercopithecus aethiops* (e_5); *Lepus crawshayi* (e_4); *Atelerix albiventris* (e_1); *Rattus rattus* (e_{25}); *Cricetomys gambianus* (e_{43}); *Galerella sanguinea* (e_9); *Crocidura spp* (e_{42}); *Heliosciurus gambianus* (e_{36}); *Avicanthis niloticus* (e_{18}); *Mus haussa* (e_{28}); *Procavia capensis* (e_3); *Tatera guinea* (e_{22}); *Genetta tigrina* (e_{16}); *Cricetomys emini* (e_{33}); *Ichneumia albicauda* (e_{10}); *Lemniscomys striatus* (e_{34}); *Hylomyscus alleni* (e_{35}) *Gnenetta genetta* (e_{17}); *Funisciurus leucogenys* (e_{41})

B: *Atilax paludinosus* (e_{11}); *Galago senegalensis* (e_2); *Protoxerus stangeri* (e_{26}); *Lemniscomys zebra* (e_{32}); *Heliosciurus rufobranchium* (e_{37}); *Steatomys jacksoni* (e_{23})

C: *Uranomys ruddi* (e_{20}); *Myomys derooi* (e_{27}); *Mastomys spp* (e_{30}); *Herpestes ichneumon* (e_7); *Malacomys longipes* (e_{29}); *Lophuromys sikapusi* (e_{31})

D: *Felis libyca* (e_8) ; *Ictonyx striatus* (e_{14}); *Mellivora capensis* (e_{15}); *Graphiurus lorraineus* (e_{38}) ; *Mandinia binotata* (e_{13}) ; *Funisciurus substriatus* (e_{40}) ; *Graphiurus naggtglasi* (e_{39}).

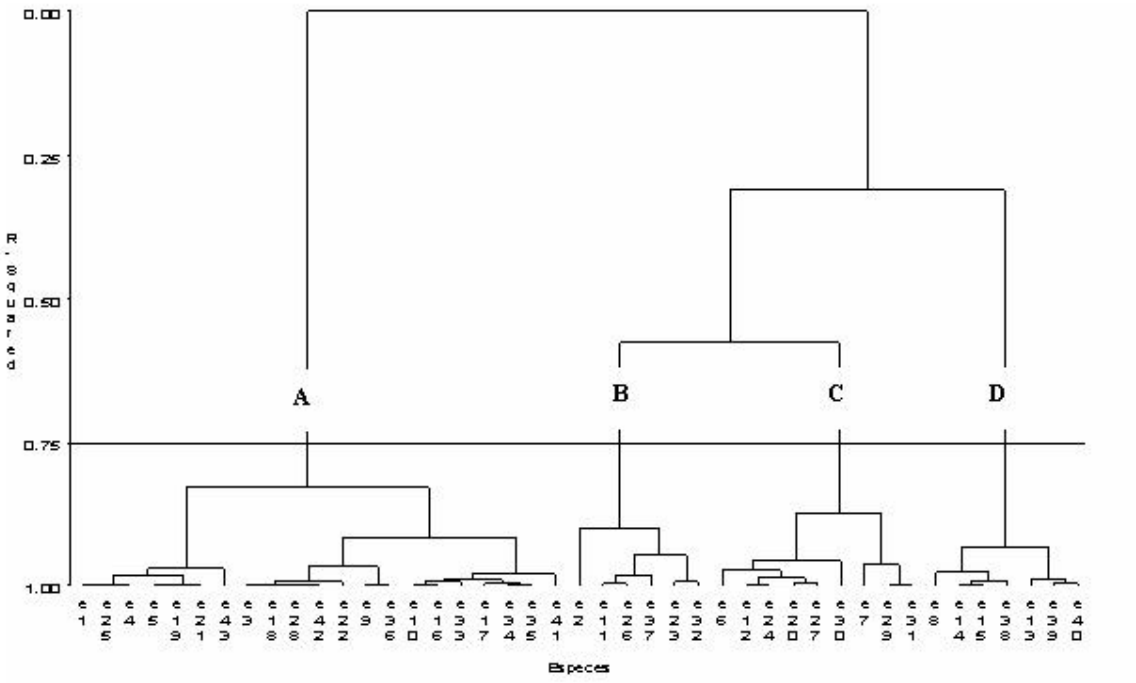

Figure 1. Dendrogram of the regrouping of small mammals the species according to their period of observation

Most local populations (79.3%) resident in the twelve villages have indicated that the small mammals species were less abundant. Moreover, the opinions of the local populations didn't differ (χ^2 = 2.28, p > 0.05) between villages sampled or socio-cultural groups. The growth and poverty levels of the local population are factors that aggravate this situation. Some studies have shown that the hunting for subsistence means can provoke a non lasting exploitation of game, and even when human density is weak, the hunters can eliminate some species of fauna by slowing reproduction (Fitzgibbon *et al.* 1995)

Economic feeding and medicinal importance of the small mammal's species

The small mammals in the sites of survey have a very weak economic importance since the species are more often consumed rather than sold. Not all species are sold. The grass cutter, the hare, the Gambian rat and the ground squirrel are the most frequently sold. The prices of transfer vary according to the species and their size. Thus, grass cutter are sold for between 4 and 6 $, the hare

costs 1 to 1.5 $ and the Gambian rat and the ground squirrel cost respectively 0.5 to 0.7 $ and 0.1 to 0.2 $. Favourite species of small mammals by the local populations have been identified following the Friedman test (Fig. 2). The grass cutter was the most appreciated species (χ^2 = 360.8, p <0.05), followed by the hare, the mongoose, the genet, the rock hyrax and the ground squirrel. The main reasons to explain this preference were that these species were current and easy has to find in dry season (60.5%) and because their meat was very good (39.5%). Small mammals are used for medicinal purposes to treat belly aches, incurable wounds, earaches, sexual impotence and abscess.

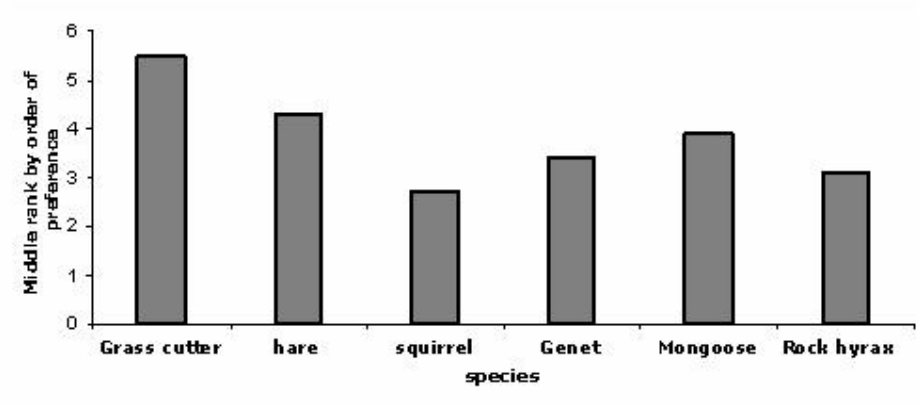

Figure 2. Middle rank, by order of preference, of the different species of small mammal used in alimentation determined with the Friedman test.

Socio-cultural values

Some species of the small mammals benefit from an exceptional statute of conservation in the riparian villages. In the past various socio-cultural groups developed beliefs, myths and legends around these small mammals' species, which allowed them to become socially forbidden and flavorous their conservation. Thus, the striped grass rat (*Lemniscomys striatus*) as totem is a concern to close to one third of the populations investigated because it represents a totem for all a socio-cultural groups (Gourmantché). This confirms the results of the studies of Mensah *et al.* 2007 on the rodent of the PBR. This totem species is followed by the ground squirrel (*Xerus erythropus*) with 11.6% having it for totem, the hare (*Lepus crawshayi*) for 7.2% of the sampled individuals, the galago (*Galago senegalensis*) for 6.3%, the hedgehog (*Atelerix albiventris*) for 2.3%, the Gambian rat (*Cricetomys gambianus*) for 2.1%, the genet (*Genetta* spp) for 1.7%, and the zorilla (*Ictonyx striatus*) for 1.3%. The Spotted necked otter (*Lutra maculicollis*) as totem only concerns 0.7% of the population surveys (Fig. 3).

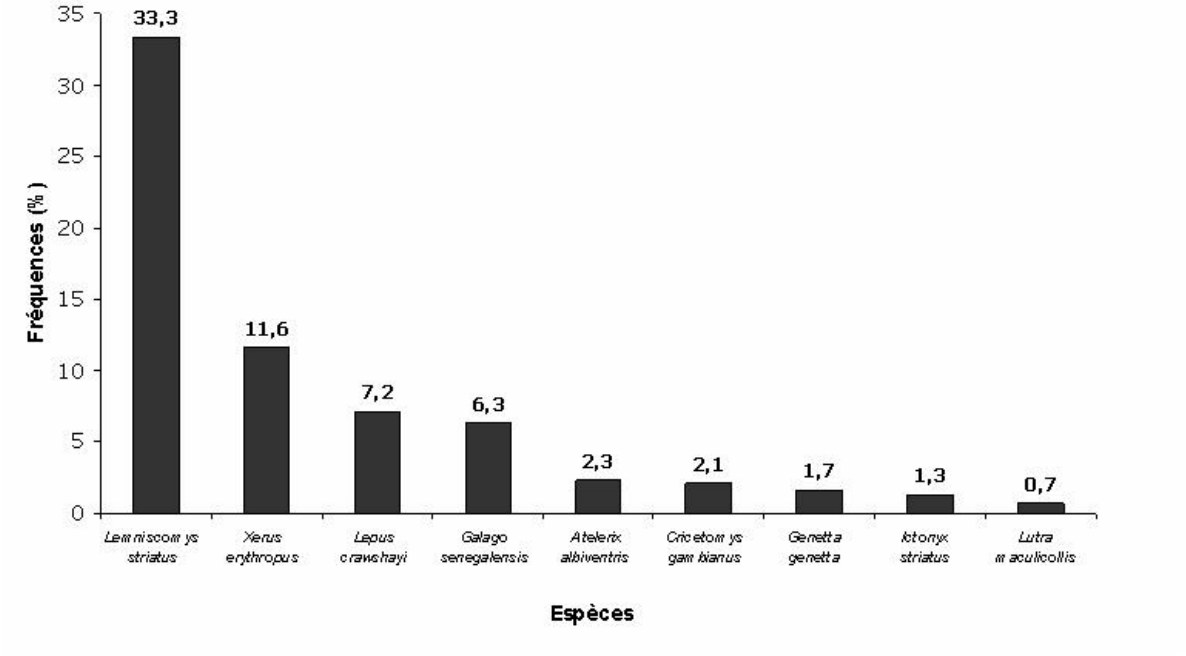

Figure 3. Small mammal species of special social significance (as totems) to local populations.

Hunting techniques of small mammals according to the villages sampled

Although a large proportion of the trapping techniques consist of using dogs and sticks, each village investigated also had specific trapping techniques of the small mammal readily identifiable from the correspondence factorial analysis (Fig. 4). The second axis of variation (vertical axis), with an eigenvalue of 0.242, permits to show that Birikiri (Bir), Kayarga (Kar), Tchatingou (Tch) and Firou (Fir) villages usually use the gun (F) and trap to jaw (B) for the capture of the small mammal. The first axis of variation (horizontal axis), with an eigenvalue of 0.469, separated Kaoubagou (Kao) form Tanougou (Tan), Batia (Bat), Tchanwassaga (Tchan), Tiélé (Tié), Kané (Kan), Nanébou (Nan) and Dassari (Das). With the positioning of the trapping techniques on this axis, Kaoubagou (Kao) is the only village which usually uses the traditional trap such as trap to cable (C), trap in bow (D), and trap to the mice (E) for the small mammals capture species. Whereas in the negative side of this axis we notify that trapping techniques such as the stick use (A), dogs use (H) and excavation of the terriers or holes (G) are more often used in Tanougou (Tan), Batia (Bat), Tchanwassaga (Tchan), Tiélé (Tié), Kané (Kan), Nanébou (Nan) and Dassari (Das). Thus, the villages far from the BRP like Birikiri, Kayarga, Tchatingou and Firou use the most destructive technique of hunting compared to the nearer villages. This is translated the effort of conservation by this reverse manager. The hunters of Kaoubagou remain those of the only village of the sample which are attached to the tradition with the presence of three traditional traps. It is also the only sampled villages where a king exists and where the society is attached to an ancestral tradition of conservation.

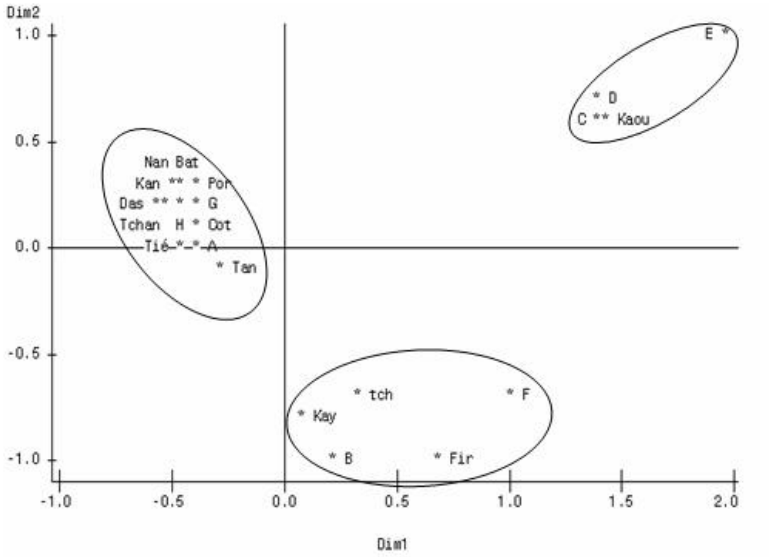

Figure 4. Correspondence factorial analysis of small mammal trapping technigues among villages studied.

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ALMACIGA RESIN GATHERING BY INDIGENOUS PEOPLE OF PALAWAN PROVINCE IN THE PHILIPPINES

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Introduction

The island province of Palawan has a population of about 700 000, the majority of which are migrants of mixed ethnic origins. Migration has steadily increased, brought about by the rich natural resources (land, forest and marine) and increasing demand of the tourism industry. Indigenous to Palawan are three main ethnic groups or indigenous peoples: 1) *Bataks* - numbering around 400 households inhabiting the northern central part of the island; 2) *Tagbanuas* in the central Palawan area of about 7000 households; and 3) *Palau'an*, the largest group estimated at 30 000 households dwelling in the southern part of the island. Palawan is considered the largest of the Philippines' 76 provinces with a land area of 1.49 million ha comprised of 1300 small other islands.

Resource Use

Indigenous communities utilize non-timber forest products (NTFP) to earn their living. Foremost of which is the extraction of almaciga resin. The almaciga (*Agathis philippinensis*) tree grows well in higher elevations from 200-2000 m asl. Because the Philippine government prohibits felling of the tree, the almaciga's use is limited to its resin, known in world trade as Manila copal. Almaciga resin is used in the manufacture of varnishes, paints, soaps, plastics, printing ink, linoleum, shoe polish, floor wax, etc. Although regarded as a minor forest product, almaciga resin is one of the country's dollar earners. In 2004, the Philippine Forestry Statistics reported that 230 000 kg of almaciga resin valued at US$ 222 000 were exported.

Logging has been banned in Palawan following the 1994 Strategic Environmental Plan for the province. Under this plan, emphasis is being given to the integration of communities within the forest management framework. In effect, the result has been that large areas of what was previously timber resource land are now being claimed by the natives under the plan's social forestry programme. Local communities in the island province are now recipients of the program with the strong assistance of NATRIPAL, an association of indigenous people. Hence, former logging concession areas have been granted to these local communities. The primary objective of NATRIPAL is to secure the freedom of indigenous people within their “ancestral domains” or native lands, and also involves the promotion of the sustainable use of natural resources on such land in order to elevate or improve the quality of life of indigenous people. Inspite of declared log bans and the presence of forest sector policies, the threat to the forests and the people dependent on its resources like indigenous people has continued. This is brought about by increasing population, declining employment opportunities, and improper and unsustainable harvesting practices of NTFPs like almaciga resin.

Indigenous Practices for Collecting Almaciga Resin

Almaciga trees in the Philippines are protected and resin tapping is only permitted under license. All harvested resin has to be registered with the Department of Environment and Natural Resources (DENR) prior to its sale. In granting the land to the indigenous people of local communities, they also granted the license to harvest almaciga resin.

While tapping almaciga is a veritable economic activity for these people, very traditional, unscientific and injurious methods of extracting the resin are followed by indigenous peoples in Palawan:

a) No restriction on diameters of trees to be tapped ; b) Initial cut of four inches wide (horizontal cut) with no definite thickness; c) Re-chipping of one inch thickness per cut; and d) Maximum of eight tapping cuts with no definite sizes for bigger trees and four tapping cuts for smaller-diameter trees.

Tapping is strenuous work. The almaciga trees are located a day's walk from the communities situated in the lower land. About 75% of a community, both men and women are involved in collecting the resin over the four-month harvesting season from January to April. Collectors spend 3-5 days at a time in the forest gathering the resin. They need to set up temporary camping sites in the forest throughout the entire duration of resin collection.

The trees are tapped on an approximately eight- to nine-week cycle with each collector responsible for about 30-35 trees. Some tappers make new cuts on the day the resin is collected. Majority however, shorten the cycle of cutting by one week than the cycle of collecting the resin. The sacks of resin collected, which weigh 45 kg each, are put in improvised rattan containers called “ararong”. These are slung on tappers’ backs and transported on foot down inclined terrain, initially to the warehouse of local community, and from there on to NATRIPAL headquarters in Puerto Princesa City (provincial capital of Palawan). NATRIPAL pays the community PhP5 (US$12 cents) per kg of resin. In terms of harvest per month, indigenous tappers average 22 sacks or net income of PhP 1470 (US$ 32.64). These are then sold to local exporters in Manila or Cebu for double that price. Majority of the raw resins are sent abroad while some are shipped to Cebu for local processing into paints and varnishes.

Conduct of Training Program

With the goal of rectifying the wrong practices of tapping and harvesting almaciga resin by the local people, FPRDI conducted seminar/training on proper methods of tapping resin for sustained resin yield. This consisted of both classroom sessions and practicum where correct tapping practices developed at FPRDI were discussed and demonstrated. Basic structure of the stem, nature and physiology of resin production, and biological factors in relation to the tapping processes, were also given emphasis in the course of discussion. Lectures, field demonstration and hands-on-exercises and practicum in the field made up the seminar-training.

Proper Tapping Methods

Owing to the detrimental effects of traditional tapping methods, FPRDI laid down the following guidelines for the proper tapping of almaciga trees. These were based on the results of R&D studies previously conducted at the Institute.

- Tap only trees with diameter at breast height of at least 40 cm;
- Remove loose barks, dirt and other foreign materials and lightly scrape the portion to be tapped. Start the first tapping at a point not more than 30 cm above the ground;
- Make a horizontal cut above 2 cm wide and 30 cm long and not beyond the bark, using a razor-sharp broad-bladed bolo or a large knife. Tapping more than twice around the tree circumference is permitted, but the distance between tapped portions should be about 60 cm or twice the length of the cut. While cutting, take utmost care to avoid damaging the cambium;
- Spray a mist of 50% sulfuric acid solution about 15 cm from the cut portion to stimulate resin flow, using one pass of a pint size capacity plastic squeeze sprayer. Since all acid-damaged tissues are removed in re-chipping, the right amount of acid prolongs the tree's tapping life; and
- After a week when resin exudation stops, a fresh cut may be made immediately above the previous one of the same length but lesser width (0.4 to 1 cm wide). Apply acid as before. Tap vertically upward.

Conclusions

Tapping is a veritable economic activity among farmers and forest settlers especially IPs. Understanding the basic structure of the stem, nature of resin production and biological factors in relation to the tapping process, and applying the proper tapping techniques can help: a) prolong the tree's life; b) increase production of quality almaciga resin; c) increase income of tappers; and d) help in the forest conservation program of the government.

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INDIGENOUS COLLECTION AND MARKETING OF WILD HONEY AND ALMACIGA RESIN IN PALAWAN: THE NATRIPAL EXPERIENCE

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Introduction

NATRIPAL (Nagkakaisang Tribu ng Palawan), an association of indigenous people (IPs) in the island-province of Palawan was organized in 1989 to advocate for recognition of ancestral tenurial rights; and to enhance indigenous people's organizational capacity in sustainable management, trading and marketing of non-timber forest products (NTFP) such as wild honey and almaciga resin. Three indigenous or local communities, e.g., Kampung Ulay and Kayasan in Puerto Princesa City (provincial capital of Palawan), and Punta Baja in Rizal Town are the sites of FPRDI-ITTO project entitled "Collection, Utilization and Trade of Tropical Non-timber Forest Products in the Philippines" where data and information in this presentation were taken. In addition the said communities were also recipients of a forestry programme under the 1994 Strategic Environmental Plan for the Province of Palawan. Hence, large areas of previously timber resources land are now granted by the government to these IPs under the Plan's social forestry programme which includes the extraction of wild honey and almaciga resin.

Almaciga resin

Cutting of almaciga (*Agathis philippinensis* Warb) trees in the Philippines is banned and thus its utilization is restricted to its resin. Known as Manila copal in international trade, the resin is used as an ingredient in the manufacture of paints, varnishes, lacquer, soap, printing inks, linoleum, shoe polish, floor wax, plastic water proofing materials, etc. Locally, it is used for incense in religious ceremonies, fuel for torches and as caulking substance. The Philippines is the second largest producer of Manila copal in the world with average exports of 350 tonnes per year. In 2004, the country exported 230 000 kg of almaciga resin worth US$222 000 .

Palawan alone produces about 80% of Philippines' resin production, and is considered as the center of production for almaciga resin in the Philippines. Moreover, the island-province is known to be the producer of the best, highest quality almaciga resin in the country. Resins from this island province are shipped to traders in Metro-Manila and Cebu (central Philippines), either for export or for local processing into paints and varnishes. The marketing chain is composed of tappers, the "kapatas" (middleman), almaciga concessionaires or licensees, traders and end-users.

IPs Practices of Collecting Almaciga Resin

Tappers has "kapatas" or leader. He makes cash advances from the leader of a federation/association working under NATRIPAL. The cash advance is used to buy provisions - rice, sardines, noodles, cigarettes, etc. for their stay in the forest to tap and collect resins. Part of these provisions ends up with the family the tapper leaves behind. The value of the goods and cash advanced to the resin gatherers is deducted by "kapatas" from the share of the gatherers on resins collected and delivered. Resin gatherers spend 3 – 5 days at a time in the forest to collect resins where they set up their temporary camping sites. The trees are tapped on an approximately 8 - 9-week cycle with each collector responsible for about 30 trees. Some tappers make new cuts on the day the resin is collected. Some shorten the cycle of cutting by one week than the cycle of collecting the resin. The sacks of resin collected which weigh 45 kg each are slung on tappers' backs and transported on foot directly to IP communities and finally to NATRIPAL headquarters in Puerto Princesa City. NATRIPAL pays the community PhP 5 (US$ 12 cents) per kilogram of resin. In terms of harvest per month, IP tappers average 22 sacks or net income of PhP 1470 (US$

32.64). These are then sold to local exporters either in Manila or Cebu for double that price. Majority of the raw resins are sent abroad while some are shipped to Cebu for local processing into paints and varnishes.

While tapping almaciga is a veritable economic activity for these people, very traditional, unscientific and injurious methods of extracting the resin are followed by IPs in Palawan, viz: a) no restriction on diameters of trees to be tapped; b) initial cut of 10 cm wide (horizontal cut) with no definite thickness; c) re-chipping of 25 mm thickness per cut; and d) maximum of eight tapping cuts with no definite sizes for bigger trees and four tapping cuts for smaller diameter trees. The IP tappers are: 1) unfamiliar with the legal framework associated with almaciga resin utilization; 2) have insufficient knowledge in almaciga resin tapping, and also cleaning and grading of resin; 3) unfamiliar with trading and marketing of resins; and 4) do not know the pests and diseases of almaciga trees.

Wild honey

Another economically important forest product from these IP communities are the wild honey. There are two types of bees in Palawan forests but the better honey comes from the “pukyutan” bees (*Apis cinerea* and *A. mallifera*) whose nests can be seen high up in the branches of the towering manggis (*Koompassia excels*a) trees. With the assistance of rattan hoists, collectors climbed up the trees and the nests lowered using pulleys. Usually this takes place at night when the bees are less active. Up to four different nests may be found on one tree, each of which could yield around 4 liters of honey. Twenty liters of honey sells for around PhP 250 (US$ 5). About 50 gallons of honey could be collected within 3 months per person.

Honey gathering is an integral part of Palawan's indigenous culture. Considered as a male activity where women participate only in the processing and marketing. Climbing for honey hives is the most laborious part but is considered enjoyable, hence, honey season (February to April) is a much anticipated time among the indigenous communities. The common practice of honey processing is by pressing the honeycomb to extract the honey. Whereas, the hygienic practice is by cutting the upper part of hive above the combs and let the honey pass through a cheese cloth.

NATRIPAL purchase honey from January to March. It assigns 3 people at most to handle its honey processing and trading during the peak season. They take care of the activities involved, e.g., receiving, quality grading, processing and marketing of honey.

Market Flow of Honey

Two forms of marketing channel were identified in the three IP communities studied. The first channel involves the flow of commodity from the gatherer to the NATRIPAL headquarters in Puerto Princesa City. NATRIPAL would either sell the honey to the local users or store them until they reach an appropriate volume for delivery to Manila.

The longer marketing channel that was identified was the channel leading to the provincial buyers. It started with the honey gatherers, then to the barangay and municipal buyers. Then it will pass through the provincial buyers and finally to the local users and/or Manila market.

Problems encountered

The main problems encountered by NATRIPAL in its honey marketing operations are: a) high moisture content; b) impurities; c) fermentation; d) diversity of honey - flavor, color, aroma and others; e) adulterations; f) standardization requirements of buyers; g) pricing; and h) irregular supply

Conclusions

NATRIPAL in collaboration with FPRDI-ITTO project brought Palawan's indigenous communities the idea of community organizing, giving priority to the livelihood concerns of honey and almaciga resin gatherers and traders.

The interaction between NATRIPAL and FPRDI has enlightened the IPs on the possibility of self-determination and the importance of their tenurial holdings, thus maintaining their hold on the forest resources on which their livelihood is anchored.

The NATRIPAL community is just one example of a group of indigenous people who are capitalizing on the diversity of local forest products. Not all forest products collected will justify significant investment but in more cases, simple development techniques will be enough to make significant increase in the incomes of the local communities.

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IMPACTS OF KNOWLEDGE BASED DECISION SUPPORT SYSTEMS ON FOREST MANAGEMENT

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Introduction

In the relationship between decision support system (DSS) and knowledge management (KM), Metaxiotis et al. (2003) suggest that DSS and KM are interdependent activities In all cases, decision makers always combine different types of data and knowledge available in various forms in the organization. Knowledge is a fundamental resource for developing a knowledge-based DSS and these systems can provide important support to forest management. Accordingly forest management is required to introduce changes in order to improve there decisions, productivity, profits, and to protect the environment.

In this paper I will focus on decision making, knowledge-based and forest management, and then review the impacts of knowledge-based DSS on forest management. Integrating DSS and KM could provide some benefits to forest management ,enhance quality of support decisions, and improve the economic and social elements.

Background

There are many definitions of DSS, KM and forest management, but I will focus on the related and important definition to this paper:

Decision Support Systems: interactive computer-based systems intended to help decision makers utilize data and KM models to identify and solve problems and make decisions with in different organizations (Carlson & Carlson 2001).

Knowledge Management System: a system that provides the intellectual platform for an organization to integrate 'intelligence,' 'design' and 'choice' phases in a systematic decision-making process, KM system should support the creation, gathering, organization, and dissemination of knowledge (Drucker 1988, Simon 2000)

Forest Management: a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in sustainable manner (UNFCCC 2001).

Methodology

On this paper I use Information flow and a literature survey from all possible sources and formats based on knowledge based DSS and forest management:

Information Flow. According to Barwise & Seligman (1997) the Information Flow is an effort to develop the logic of distributed systems, showing the notion of forest management, and the links between departments, which can all be controlled with the Information Flow method. I use information flow method to understand the notion, structure of and decision making process in the forest management

Literature Survey. My review on the subject noted that there are no publications that deal with a knowledge based decision support system for forest management in spite of the importance of the subject, but I was collected data for this paper from different related sources.

Development of Knowledge-based decision support systems

My literature survey and citation studies (Alavi & Joachimsthaler 1992, Arnott & Pervan 2005) suggest the broad historical development of DSS; first one examines model-driven DSS, and then move to data-driven DSS and decision-making information systems and notes the growing status of such systems. The geneses of communications-driven DSS are then briefly explored and classified into two

types of group DSS, model-driven and communications-driven. Developments in document storage technologies and search engines then made document-driven DSS more generally offered as web-based systems. The last progression summarizes major developments in Artificial Intelligence (AI) and expert systems that made suggestion or knowledge base-driven DSS practical.

Figure 1. Development in Knowledge-based Decision Support Systems

Knowledge-based DSS and Forest Management

As discussed by Dyer (2000), the knowledge based DSS has been the key to successful, effective, management of the processes for actively disseminating and applying knowledge for organization forest management activities, development of forest management strategies and plans. The concept of forest management implies stewardship and therefore requires good decisions based on knowledge to handle the major challenge faced by foresters. DSS based on KM systems improve the process of making decisions, by choosing and making good decisions based on knowledge to solve different problems of forest resources protection and management. According to Schmoldt & Rauscher, 1996) we can solve sustainable forest management problems effectively by learning how to continually improve our decision-making processes and our decision-support capabilities and thereby more effectively manage these resources, relying on knowledge based DSS to evaluate environmental, economic and social forest management issues and options.

Impacts of Knowledge based DSS on the Forest Management

The result from integrating DSS and Knowledge based could make some benefits to the economic and social functions of the forest management in sustainable manner:

Economic impact. The main purpose of forest management, however, is to minimize adverse human impacts while maximizing the economic value of the forest. Thus the main objective of DSS based on KM is to help the forest manager to plan his interventions in the forest to maximize the economic return, while minimizing the adverse long-term impact by storing all relevant in computer systems.

Social impact. The knowledge–based DSS can serve all those who have a role in forest management and can facilitate cooperation among them. This cooperation may extend to the beneficiaries of the outputs of the system, and encourage a culture of knowledge-based sharing among foresters.

Results and Discussion

In this paper I discussed how knowledge-based decision support systems can improve decision-making in forest management, reviewed the structure and development of DSS and knowledge based systems, and the possible impacts of these systems on forest management. I found that integrating DSS and KM could make contributions to forest management, enhancing the quality of decision-making based on better knowledge of trends and patterns in forest conditions. However, what is still required is to build up forest management memory and support KM functions I also found that there can be a positive impact of knowledge-based DSS for enhancing and improve the economic and social impacts of forestry management.

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TRADITIONAL WEATHER FORECASTING FOR SUSTAINABLE AGRO-FOREST MANAGEMENT AND POVERTY ALLEVIATION IN ILOCOS NORTE – PHILIPPINES

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Introduction

The province of Ilocos Norte is exposed to the southwest monsoon and is shielded by the Cordillera mountain ranges from the northern and northeastern air currents. This results in a well-marked wet season (June to November) and dry season (December to May) that bring in excessive rains and extreme droughts. Average annual rainfall in the province is about 2000 mm, with almost 90% of the rainfall concentrated in the wet season. Of the total population of a little more than half a million (NSCB 2000), the majority lives in the rural areas which depend on the agro-forest livelihoods.

The total land area in Ilocos Norte is 0.36 million ha, about one-third of which is classified as agricultural land. The narrow coastal plain with highly eroded soil and dense population has made for the development of a very hardy group of people, the *Ilocanos*.

Degradation of soil, decreasing water resources and changes in the climate, are the main problems in sustainable agro-forestry development in Northern Philippines particularly in Ilocos Norte. These are brought about by the cultivation practices of majority of the poor Iloco “kaingeros” or farmers who rely heavily on uplands for their livelihood but lack awareness on the consequences of inappropriate farming practices.

Most Iloco farmers live in the uplands due to lack of land to till and poor income opportunities in the lowland. Here they clear the forests with their “kaingin” or slash and burn practices or “*panag-uma*” and plant rice or corn as major crops and vegetables in the hillsides in one or two cropping seasons. Because of poverty, the local people are forced to destroy the forests. The biophysical environment in these areas is fragile, requiring utmost care in farming practices to maintain sustainable farm production. Otherwise, soil erosion occurs causing floods and damages to life and property. The heavy siltation downstream cause low productivity in the lowlands.

Multi-lateral agencies such as the World Bank are urging that forecasts be made available to small-scale farmers, to increase food security (Woytek 2005). Disaster-preparedness strategies have begun to take account of such forecasts, and there is considerable interest in assigning them an economic value. However, field studies of the impact of recent forecasts suggests that there is a considerable gap between the information needed by small-scale farmers and that provided by the meteorological services.

The objective of this study is to create awareness of the value of traditional knowledge in weather forecasting particularly its potential contribution to sustainable development and poverty alleviation especially at a time when such knowledge is being dismissed as superstitious beliefs.

Methodology

The study came into two phases: 1) documentation, and 2) validation. The documentation phase was conducted in selected remote barangays of 19 municipalities of Ilocos Norte. Purposive sampling was employed in choosing the 204 key informants. Commonly used indicators of the onset of rainfall, upcoming rain or adverse weather conditions in relation to agro-forest management were asked.

Socio-demographic profile, adaptive measures of coping with typhoon or flood or drought were also among the data gathered. Qualitative and descriptive statistics were used to analyze the data.

Cooperators were assigned to monitor and record the date of occurrence of their respective indicators and the actual dates/days of rainfall occurrences in their locality. Data gathered from PAGASA Agromet Station in Batac and in Laoag Synoptic Station include: rainfall data, relative humidity, and cloud cover, forecast on the occurrence of low pressure and other adverse weather conditions.

Results and Discussion

Key informants in the documentation phase were farmers, housewives/housekeepers who share with light works in the farm, and fishing folks, aged 60 years and above. Most of them were elementary graduates while some finished high school, and others did not have any formal schooling. Majority of informants have been engaged in farming for 31 to 50 years, and have been residing in their respective places since birth while some by affinity. As to economic status, majority of the respondents have income below the poverty line.

Informants indicated a total of 66 weather lore grouped into: atmospheric/astronomic phenomena indicators, phenology of plants, and animal/insect behaviors. The informants rely on a combination of atmospheric phenomena, animal behavior and phenology of plants, while the rest either rely on plant behavior or atmospheric phenomena alone in predicting the weather.

Weather is an important variable influencing crop production. Given their levels of literacy and poverty, geographical location and livelihood, old folks can only resort to traditional weather forecasting methods. The traditional practices that are soil-conserving and are sustainable which were documented and validated is the harmonizing of land preparation and rainfall activities with rainfall pattern. Farmers have to watch for their plant indicators, unusual behaviors of birds and insects that signal the on-set of rainy season. This is important because they have to prepare their upland farm so that cover crops will be on time during heavy rains to prevent erosion. Their traditional weather forecasts, and knowledge of when to expect long or short rainy seasons, would enable the farmers to plan appropriately which crop is suited for a particular season.

Additionally, forecast of adverse weather conditions is critical in their planning and programming of agro-forest activities because failure to predict such conditions would mean decrease in yield or total lost of production, waste of resources and lost of lives. Traditional knowledge of storm routes and wind patterns enables upland residents to design their disaster management in advance. Indicators of drought, typhoon or flood would warn them to store basic needs, repair their houses that are usually made of light materials like bamboo and cogon grass and ensure their herds for safety. If they see a solar halo or ring like shape around the sun (solar) or moon (lunar), storm is sure to occur. If they observe that the nests of birds and beehives are built high, flood is imminent. The indicators of adverse weather conditions such as heavy rains, typhoons or floods, would advise the farmers to repair their houses, tighten the loosened ceilings or walls; preserve and stockpile food and fuel, gather more fire woods and mill more rice; and have their pastures, livestock and poultry put in safe place.

Traditional weather forecasting plays a critical role in the sustainable management of agro-forests and poverty alleviation in Ilocos Norte. Farmers have combined traditional and modern weather forecasting systems to help in agro-forest management. This knowledge may contribute to improved development strategies in several ways such as for identifying cost-effective and sustainable mechanisms for poverty alleviation that are locally manageable and locally meaningful. Unfortunately much of this kind of local knowledge and information has not been used to its best advantage. In fact it may be ignored by scientists and not incorporated into development planning and formal early warning systems.

But there is a lot to gain by disseminating this kind of local knowledge as they can help farmers make more informed decisions about when to prepare land and planting materials, and how much excess food to store. It is one way to help poor families and communities become more resilient to environmental changes.

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FUNDS FOR COMMUNITY DEVELOPMENT THROUGH TRADITIONAL KNOWLEDGE: AN EXPERIENCE OF COMMUNITY FORESTRY IN NEPAL

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Introduction

Community forestry (CF) as a participatory forest management has been practiced since 1970s in Nepal, which is understood as a pioneer country to initiate the development of partnership between local communities and government. Community forest user group (CFUG), an autonomous entity, has responsibilities to manage forest resources by making its own forest management operational plan and constitution incorporating the local knowledge and local context. The government provides technical support and legal advices to the CFUGs which are recognized as real managers and decision makers of local forest resources. Such management was initiated due to smooth functioning of indigenous forest management practices in scattered patches in the hills (Gautam 1988). Therefore, the initiation of CF program is the recognition of traditional knowledge of local users. Furthermore, CF is an institutional innovation empowering local communities in managing forest resources (Kanel 2004).

During the past few years' annual reports the financial and other benefits, apart from the basic needs fulfillment, are being generated from community forests (Bampton *et al.* 2006). The main sources of funds are from selling of timber and NTFPs. CFUG funds are being used to conduct income generating activities (IGAs) such as agriculture, livestock, bee keeping, shopkeeping, trade skill development (Chand & Ghimire 2007). Bampton *et al.* (2006) also explains a provision of an emergency fund managed under the CFUG funds for health, natural disasters, and birth control. Pokharel (2000) concludes that the CFUGs have been using their funds for forest management (FM), community development (CD) and organization development according to their approved plans. Dangol (1999) claimed that CFUG fund has been expensed more on community development than on forest management. It is also noticed the CFUGs are spending their funds for remuneration followed by infrastructure, forest development and loan out (Gentle 2000). Although the CF funds have been utilized for community development emphasizing pro-poor, there are emerging issues on participation of the poor in decision making and equitable benefit sharing. Therefore, this study explores the indigenous approach of fund raising and participatory decision process on fund mobilization. It also investigates the problems associated with equitable benefit sharing of CF fund.

Methodology

The study was carried out in Sundari CFUG which is located in Amarapuri VDC, Nawalparasi district of Nepal. It was selected on the basis of group heterogeneity which contains very rich - 3.6%, rich - 12.14%, medium - 33.14%, lower level - 30.11%, poor - 12.46% and very poor - 8.46% of total number of households. While selecting CFUG, criteria of group dynamics were also considered. This CFUG was established in 1995 and implementing different IGAs ranging from CD to FM. This CFUG's records, meetings and assemblies' minutes, operational plan, audit reports, DFO/Range post database, Journals and other relevant published and unpublished literatures were reviewed as secondary sources of information. A questionnaire survey with 140 households (12%) of Sundari CFUG was conducted to collect data. Apart from focus group discussions, interactions with executives and general members were also carried out. Direct observations of forest management and community development activities were performed. Discussions with representative users of each ward of Amarapuri VDC were also held.

Results and Discussion

Sundari Community Forest is situated between 156 m to 829 m above sea level. The total area of forest is 385 ha with 1252 households. The average family size of household is 6.04 with standard deviation of 2.06 and mode of 5. The CFUG has developed five-year forest operational plan. Besides simple wealth ranking the CFUG has identified 12 households as the most deprived and poor ones. Separate sub-committee of poors has been formed and allotted 0.80 ha of forest for IGAs. The sub-committee has prepared a separate five-year operational plan for IGAs on the allocated land. Under the scheme, they have cultivated Kurilo (*Asparagus*), Amriso *(Thysanolaena agrestis*), fodder trees, medicinal plants; and goat keeping, with short gestation period for regular return on their small investment. The management scheme emphasizes the use of the indigenous knowledge and local resources available within community.

The CFUG generated funds by selling of fuel wood, round woods, planks, NTFPs and nursery plants. Also they generated incomes from entry pass (token) distribution, commission from selling books, application fees, telephone charges, penalties, facilitation charges, subsidies, membership fees, goat farming, hall rent, prizes, canteen bidding, bee keeping, grass selling and interest from bank. On an average the CFUG generated about NRs 1 317 040 per year. The share from selling wood (round wood) to the annual income was 52.64%. Similarly, the contribution from selling fuel wood was 12.72%, from subsidy and grant was 7.11%. The share of interest earned by lending out loan was 5.31% and from goat farming was 1.26%. The CF was investing also on the community development such as bridge construction, road construction, support to schools, bio-gas installation, and also pro-poor programmes such as rehabilitation of disables and health services. While carrying development activities, a certain percentage of the total cost was contributed by concern organizations and provided to CFUG as subsidy to carry out the proposed programmes. The community has special annual plan of making small houses for the deprived poors and 3 among the 12 had already been benefited last year. The trend of expenses shows that the amount allocated in CD is increasing year to year. The amount expended in CD and poverty focused programmes seems justifiable. The overall expense of the group in three consecutives years is summarized in the following table below.

Table 1: Expenses of Sundari CFUG

Expenditure	Year wise Expenses (NRs)			Exp/Year	%
	2003	2004	2005		
Forest Development	346,526	419,064	432,144	399,245	25.7
Community Development	125,000	194,500	386,282	235,261	15.2
Poverty Focused	60,228	127,124	117,248	101,533	6.5
Institutional Development	71,480	83,862	63,559	72,967	4.7
Office Management	356,707	446,848	425,833	409,796	26.4
Others	352,891	182,276	465,172	333,446	21.5
Grand Total	1312832	1453674	1890238	1,552,248	100

Data source: Field survey 2006 (Roughly Nepalese Rupees -NRs 65= US$1)

The people of all wards (1 to 9) of Amarapuri VDC were benefited from this CF fund mobilization. The ward level meetings prior to assembly were being adopted to gather expectations and needs of local users. Among the respondents, 73% appreciated the methods applied for the planning, 20% found to be indifferent and only 7% totally disagreed. All CFUG members participated in the general assembly discussed on activities to be done under available budget, and finally prioritized the programmes. A one-year programme will be prepared on the basis of recommendations and suggestions received in the general assembly. Finally, they will assign out these approved activities. Major expenses were only being done as per the decision made by the general assembly.

According to the respondents, dependency and needs of users upon the forest resources differ according to socioeconomic conditions. The study shows that there is a strong relationship between the group's heterogeneity in economic levels, and the expectations and needs for forest products which certainly affect the willingness to participate in CF activities ranges from CD to FM. As the limited sources and fund generated from FC can not fulfill the demands of all users, they have been practicing a participatory and bottom-up planning process, where the expectations of users were explored, prioritized and finalized by their own participatory decision making process. Local methods, indigenous knowledge and poverty focused activities to generate fund, and way of investing generated

funds, have been considered during planning. Seventy eight percent respondents said that the participatory planning process has increased the participation of users to manage, as well as the effectiveness of managing, forest resources. They considered the CF fund as an important one to implement different kinds of basic development infrastructure within their society by mobilizing local resources and indigenous technologies.

At management level, the members of executive committee expressed that the prioritization of the programmes and budget was dominated by ward-based feelings, and hindered the perfect participatory way of need assessment. They thought to have better and effective CD activities in the future once the feelings of the political boundaries minimized. As poor and marginalized people in this community are still dominated by the elite group, they could not share their own views and needs in the assembly. Fifty two percent of the respondents expressed that poor CFUG are fighting for their daily livelihoods and they are not concerned much in the decision process. Although there is certain share of expenses allocated to pro-poor, there are still needs to do much in the decision level for equitable benefit sharing.

Conclusion

The CFUGs do not only succeed in managing the untapped resources effectively and efficiently but also become a focal point for community development. Through the participatory decision making process, the CFUGs are able to address the expectations and needs of most users. From the collective actions, they were able to generate substantial income at local level and to spend on forest development, community development, poverty focused programmes, and local institutional development. The motivation and commitment for actions together with the traditional and indigenous knowledge led them to achieve the common goal, which ultimately contributes on poverty alleviation from the grassroots. Still the feelings of political boundaries among users and power control is with the elite hinder potential CD activities and are obstacles to equitable benefit sharing.

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TRADITIONAL KNOWLEDGE OF THARU OF NEPAL ON MEDICINAL PLANTS AND HEALTHCARE SYSTEMS

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Introduction

Herbs have been used for curing different ailments for thousands of years. Even in the modern era, the rural populations, especially the indigenous peoples of third world countries, primarily rely on medicinal plants for healthcare rather than using modern medicine. Traditional medicine include diverse health practices, approaches, knowledge and beliefs, incorporating plant, animal and/or mineral based medicine, spiritual therapies, manual techniques and exercises, applied singularly or in combination to maintain wellbeing as well as to treat, diagnose or prevent illness (WHO*)*.These approaches to the health belong to each country and have been handed down from generation to generation.

Nepal has a unique biodiversity with its varied landscape, with a fauna ranging from those in the sub-tropical climate in the low lands to those in high mountain areas. About 70 ethnic groups have their own traditional knowledge of the healing powers of plants found in where they live. More than 800 species of plants have been reported to have medicinal and aromatic value in Nepal. The *Tharus* are the indigenous people living in the Terai plains on the border of Nepal with India. This is the largest and oldest ethnic group of Terai region living in the villages near dense malaria-infested forest, in regions that were isolated over the millennia allowing them to develop unique culture (Bista 2004*)*. *Tharu* comprises 5.37 % of the total population of Nepal *(*CBS 1995*)*. Tharu are endowed with a vast knowledge of medicinal plants, having strong beliefs in the supernatural powers of plants for the prevention or treatment of various ailments, which is passed orally from generation to generation without any written records being kept. Therefore, these traditional and indigenous knowledge and practices are weakening and, in many cases, vanishing altogether.

Methodology

This study was carried out in *Tharu* villages of Parsauni, Pithauli and Harkapur Village Development Committees (VDC) of Nawalparasi district in the southern part of Nepal. These villages are culturally mixed but dominated by *Tharus*. All the three sites are along the western bank of Narayani River adjoining to Chitwan National Park, one of the World Heritage Sites.

The methodologies used for this study were: group discussions, semi-structured interviews with key informants, in-depth case study, and direct and participants' observations. The folkloric information regarding traditional healthcare practices, their local names, plant products or parts used, forms of application and methods of administration, etc. of 102 species were gathered and documented. The dressing patterns, rituals and other various activities related to socio-cultural behaviors were also observed and recorded. The field survey accompanied by traditional healers *(Guraus)* was carried out in the forests and marginal lands in order to identify and record the names of plants, methods of collection, and availability and conservation status.

Results and Discussions

Traditional healthcare system of Tharu

It is believed that *Tharus* belong to the ancient Nepalese, which came from the original, autochthonous people of the subcontinent. They are the only one who managed to eke out a living in the Terai during

the malarial infestation. From time immemorial, *Tharus* have developed a strong traditional healthcare system to cope with the situation.

Healthcare among the *Tharus* is the responsibility of the *Gurau* who performs ancient rites of protection, blessing, and healing with the help of herbal medicines. The profession of *Guraus* has been established as a family profession and tradition. *Gurau* is both a healer and a priest. *Tharus* have no scientific explanation for many natural phenomena but credit the gods, spirits and ghosts with great spiritual powers. The *Guraus* play a unique role in the social system of *Tharu* community. Their magical religious practices come into operation for the diagnosis and treatment of illness. *Tharu* believe that sickness is caused by deities or spirits or witches. The medicine preparation techniques are mostly using plants, minerals and animal parts, and with traditional mantra chanting. Different *Guraus* have different expertise in the treatment of different ailments. *Guraus* follow a number of particular customs regarding the general lifestyles, prohibition of certain food, and collection of medicinal plants. The prohibition of certain food varies for different diseases and also for different herbs. Age of tree, time of collection, parts to be used, grain size, weight and concentration, are very important aspects during the preparation of medicine. Diagnoses of the disease are done by reading the palpation of the radial pulse and other characters of the patients, to determine the nature and condition of the disease. Common diseases and health problems treated by the *Guraus* are pneumonia, cough and cold, fever, stomachache, gynecological problem, infertilities, piles, skin disease, diarrhea and dysentery, ailments related to bones and joints, poisons and mental disorder, gastritis, etc. *Guraus* are very much conscious on the doses and constituents of the medicine as per their knowledge and experience. From experience, they know how much should be given to the patients.

Plants used for medicinal purpose and mode of use

Medicinal and aromatic plants, including trees, shrubs, grasses and vines, are a critical resource for *Tharu* traditional health care systems. A total of 102 plant species being used for medicinal purpose by the *Guraus* were recorded from the study sites. Most of them are collected from wasteland or nearby forest. For some plants, they need to go to the core area of national parks. In addition, they also purchase some of the plant parts and minerals from the high mountains. The plant species from Leguminosae, Euphorbiaceae, Compositae, Labiatae, Verbenaceae and Cucurbitaceae families are most frequently used for medicinal purposes in the *Tharu* communities. According to the parts used, roots are used most often, followed by fruit, bark, leaf, tender shoot, whole aerial parts and plant sap.

Different modes of treatment have been observed for different illnesses. Generally bathing with the concoction is found common to cure skin disease. Paste of some plants was plastered to set dislocated or fractured bones or muscular sprain. Juice from roots and barks are given to treat internal illnesses like gastritis, stomach ache, piles, and gynecological problems. Some of the illnesses like body ache, cuts and wounds, scabies, boils and skin diseases, are treated through external application. It is also found that garland made from either the root or the stem was also worn to cure illnesses like fever.

Challenges to the traditional knowledge

In the past, the *Guraus* were the only ones who treated all the illnesses in the communities. Most recently due to the access of modern medicine and the interaction of outside society, dependency on traditional healthcare system is decreasing. Poor and old people have strong belief on this traditional healthcare system. But young and educated ones prefer modern medicine. There are many cases that the diseases not cured by modern medicine were cured by the *Guraus*. Even the people from outside the *Tharu* communities come to the *Guraus* to treat very old and chronic illness. Despite the long history of traditional healthcare system among the *Tharus*, the traditional healers are worried about its continuity. The *Guraus* do not have common practice to come together for interaction and cross-sharing. As a consequence, the knowledge of one *Gurau* is deviating from another. They are also not getting the right person to pass the knowledge as the youth are less interested in this culture and tradition. After the eradication of malaria, in the Terai and inner Terai, the origin of *Tharu*,has become densely populated with hill migrants. As a consequence, the valuable plant species are disappeared from the vicinity of *Guraus*. The traditional healthcare system has not received much support and encouragement from the Government in terms of policies and programmes, and the service providing practitioners is not recognized. Further, the traditional medicines are not produced on a large scale and do not have market value since they are not sold by the practitioners. Due to the lack of proper documentation and preservation of traditional medicinal practices, low recognization of traditional

healthcare practitioners and lack of harmonization of traditional system with modern system along with scientific validation for safety and efficacy of traditional medicines, the valuable knowledge system and its practices are being threatened.

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MULTIFUNCTIONAL USES OF INDIGENOUS AND EXOTIC WOODY SPECIES AS FODDER TREES, FUEL SOURCE, AND IN SOIL FERTILITY RESTORATION IN THE ETHIOPIAN HIGHLANDS

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Introduction

The Ethiopian Highlands comprise about 45% of the land area of Ethiopia but harbour 88% of the human population. Insatiable demand for arable, pasture, timber and fuel has caused extreme deforestation. High livestock populations and open grazing prevent any natural recovery of forests and fodder trees. Eucalyptus plantations are one option, because Eucalyptus is resistant to browsing by livestock, grows very fast and provides good quality timber and fuel wood. In addition, the substitution of dung as fuel by Eucalyptus biomass counteracts excessive mineral nutrient losses from arable. Eucalyptus plantations, however, do not contribute to dry season fodder supply for livestock and may aggravate soil erosion if stand density is high and litter is raked for fuel. Increasing costs of fossil fuels caused a higher demand for biomass fuels in the towns, because many people can no longer afford to by kerosene or bottled gas for home use. This intensifies fuel scarcity in rural areas and increases the use of non wood fuels, such as foliage and dung, in open fireplaces, which increase indoor air pollution and associated health risks (Bruce *et al*. 2002).

The local rural population tries to overcome the shortages by growing woody plants in the protected areas around their homes to provide fodder, fuel, fencing and compostable biomass for soil improvement. Traditional indigenous knowledge attributes specific properties and uses to individual plant species. The central question of this study was how well traditional local knowledge is congruent with judgement based on modern soil and plant analysis.

Methodology

A total of 14 villages from four kebeles (lower administrative units) in the Dendi and Jeldu Weredas (districts) in the western Shewa zone, central Ethiopia, were investigated. The altitude ranges from 2900 to 3200 m a.s.l. The Chilmo State Forest borders the study area in the south. The soils are predominately Haplic Luvisols. The rainfall pattern is bimodal. The main rainy season is from July to September with annual rainfall of about 1400 mm. Barley is the most dominant crop, followed by potato and enset (*Ensete ventricosum*). Cattle, sheep and horses are dominant livestock in the study sites. Farmers mainly meet their cash demand from the sale of live animals and their products.

Tree and shrub species used by peasants were recorded based on direct observation, as well as group and individual discussions. A total of 150 farmers (respondents) participated in a questionnaire survey (following Roothaert and Franzel, 2001). The farmers' criteria for the selection and prioritization of fodder and soil improving species were identified through group discussion and categorized for the questionnaire survey. Species preference for fodder and soil fertility improvement was known using the farmers' own criteria. In addition feeding preferences of local livestock were determined by competitive feeding experiments on site.

Samples for soil chemical analyses were collected from transects from beneath the plants to open land. The total number of soil samples was 135. The soil samples were analysed for pH, organic C, total N, and exchangeable cations.

For the assessment of fodder quality, foliage (leaves and young twigs) and flower bud samples were collected. The total number of foliage and flower bud samples was 24. The samples were analysed for total N, P, K, Ca, Mg, Na, S, Mn and Fe. In addition, acid detergent fibre (ADF), acid detergent lignin (ADL), neutral detergent fibre (NDF), in vitro dry matter digestibility (IVDMD) and insoluble NDF-bound proanthocyanidins (condensed tannins) were determined.

Results and Discussion

The villagers identified nearly 40 woody species with specific values in their region. Table 1 gives a short list of plants considered particularly valuable as fodder or soil improving species.

Table 1. Plants considered particularly useful as fodder or soil improving species. Sample size was 150 households. Each household scored six preferred fodder tree species. Number of respondents indicates how many selected the species in their top 6 species listing. Score is the sums of individual farmer's ranking (1 to 6 in increasing preferences) given to the respective species.

Fodder species	No. of re-spondents	Score	Soil improving species	No. of re-spondents	Score
Hagenia abyssinica	148	790	*Senecio gigas*	142	743
Dombeya torrida	140	658	*Hagenia abyssinica*	147	734
Buddleja polystachya	136	534	*Dombeya torrida*	133	512
Maytenus senegalensis	128	417	*Vernonia auriculifera*	122	357
Dracaena steudneri	92	227	*Buddleja polystachya*	99	272
Arundinaria alpina	68	131	*Myrica salicifolia*	100	205
Hypericum revolutum	59	110	*Leonotis africana*	60	106
Myrica salicifolia	55	107	*Kalanchoe deficiens*	9	39
Maytenus ovatus	15	28	*Dracaena steudneri*	5	16
Myrsine africana	7	27	*Juniperus procera*	3	10
Olea africana	10	27	*Maytenus senegalensis*	3	8

Based on this list, the following indigenous plant species were selected for sampling and laboratory analysis: *Senecio gigas, Hagenia abyssinica, Dombeya torrida, Buddleja polystachya*. *Chamaecytisus palmensis* (tree lucerne) a recently introduced, well accepted N-fixing woody species was included too.

The content of the mineral elements P, Mg and S in the foliage and flower buds of most species was within the recommended normal requirement range for livestock. That of K, Ca, Fe and Mn was mostly above the recommended range. The content of Na in the foliage and flower bud was below the requirement. Common salt or local mineral sources such as mineral soil are needed to compensate for the low Na contents in the fodder.

The CP (crude protein) content in the foliage and flower buds of the four species varied from 188 to 234 mg g^{-1} and 124 to 170 mg g^{-1}, respectively. This is much higher than the minimum required CP level (70 mg g^{-1}) for beef cattle. The high CP content of the foliage of *C. palmensis* of 228 mg g^{-1} can be attributed to the N fixing ability of the species.

The determination of fibre fractions was done by the detergent method of Van Soest. The in vitro NDF (neutral detergent fibre) digestibility, ADF (acid detergent fibre), ADL (acid detergent lignin) and CT (condensed tannin) content of the foliage and flower buds in *H. abyssinica* was relatively low as compared to the other species. The contents of NDF and ADF in *H. abyssinica, D. torrida, B. polystachya* and *C. palmensis* were within the range reported for browse tree species by various authors. The CT content of the flower buds in *D. torrida* was exceptionally high. High ADL and CT contents can limit the voluntary feed intake, digestibility and nutrient utilization of ruminant animals (Khanal & Subba 2001). The level of ADL and CT in the investigated species are most likely not critical, because these fodders are not given as the basal diet, but only as supplements.

Chemical soil analysis was used to study the increase in soil fertility under the canopy of the investigated plant species, as attributed by the villagers in the interviews. The highest contents of organic carbon, nitrogen and phosphorus as well as exchangeable cations were recorded under the canopy of *Hagenia abyssinica* as compared to under *Buddleja polystachya* and other species. *H.* abyssinica is fairly deep rooting and constantly sheds large amounts of leaves and provides the soil in its vicinity with mulch and green manure. Kindu *et al.* (2006) reported high rates of litter deposition under 64 months old *H. abyssinica* and *Grevillea robusta* on Nitisols of Central Ethiopia. *Dombeya*

torrida and *Senecio gigas* shed a substantial amount of leaves, even though their leaf shedding pattern is not as regular as that of *H. abyssinica*.

In conclusion it is fair to state that traditional knowledge on the usefulness of indigenous woody plants in the Ethiopian Highlands is based on a good judgement of plant properties by the local rural population. Scientific laboratory analyses help to quantify soil fertility and to develop livestock feeding regimes which avoid malnutrition and potential toxicity. There is a potential for improving plant properties for the preferred use by selective breeding. This is particularly true for *Hagenia abyssinica* which shows potential as a dry season fodder tree, a soil improvement tree, as well as a timber tree.

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INTEGRATING TRADITIONAL KNOWLEDGE SYSTEMS, LOCAL INSTITUTIONS, AND FOREST CONSERVATION FOR SUSTAINABLE FOREST MANAGEMENT IN INDIAN HIMALAYAS

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Introduction

Indigenous knowledge forest is a revolutionary way to recast our conventional approach to development. Integration of indigenous knowledge and ethno-scientific approaches into contemporary frameworks for conservation and sustainable management of natural resources are now increasingly recognized and are important in polices for achieving the goal of sustainable forest management and poverty alleviation. The mountain societies are linked to natural forest ecosystem and the human managed ecosystem through biodiversity driven traditional ecological knowledge and dependent on land use activities for their livelihood concerns. Natural resource management systems in the Himalayan region are strongly linked to the indigenous knowledge systems. The cultural landscapes provides a mechanism to understand how multiple objectives (timber production, non-timber forest products, protected areas, tourism) are central to sustainable forest management in landscapes that conserve heritage values and support the livelihood needs of local people (Ramakrishnan 2002, Berkes & Davidson-Hunt 2006).

The Study Area and Methodology

Himachal Pradesh (HP) is a state of the Indian Union located in mountains of the Western Himalayas is ecologically highly diverse owing to distinct climatic and physiographic factors. It has 12 districts, covering an area of 55,673 km^2, approximately 1.7 % of the total land area of India and around 10% of total area of the Himalayas. It is situated between 30^0 22 ′ and 33^0 12′ N and 75^0 6′ and 79^0 4′ E. The elevation varies from 350 m in the foothills to 6,975 m in the mountains having four agro-climatic zones (Fig 1). The state has a population of 6.2 million, 92% of it lives in rural areas and is dependent on agriculture. The village communities utilize village commons, forest, grazing land and forest resources as per recorded rights and religious deity institutions play important role.

Participatory local appraisal methodology has been used in combination with satellite imagery, semi-structured interviews to analyze the cultural landscape of Churdhar wildlife sanctuary (Fig 2).

Results and Discussion

Steep altitudinal gradients shape variations in forest characteristics in Himalayas. Beginning with sub-tropical Pine forests in the lower altitude, species composition and biological diversity change with elevation, thus affecting the ecological and institutional aspects of forest practices. The institutional arrangements include self-initiated systems, cooperatives, corporate clan-owned forests, sacred forests, and co-managed forest and through these arrangements, communities govern the full range of different forest types across the forested landscape illustrated through cultural landscapes of Churdhar wildlife sanctuary.

Cultural landscape, TFK and forest management at Churdhar wildlife sanctuary

Land use in Churdhar sanctuary shows that it has agriculture land (127 ha, Barren/wasteland 487 ha, pasture 50 ha, snowbound area 205 ha, rocky area 3.6 ha, Reserved Forests 4867 ha (later notified as Protected area 15 Nov, 1985 under the Indian Wildlife (Protection) Act of 1972. Twenty-three villages are located within and outside of the protected area having population of 558 permanent inhabitants. The area falls into high hills temperate wet agro-ecological zones having Himalayan moist temperate forests, sub-alpine and alpine forests. The relationship of altitude with forest types and occurrence of major tree species and institutional arrangements between agriculturist, *Gaddis* (sheep and goat herders), *Gujjars* (buffalo herders) division of landscape and land use by different ethnic groups have been shown in Fig 3.

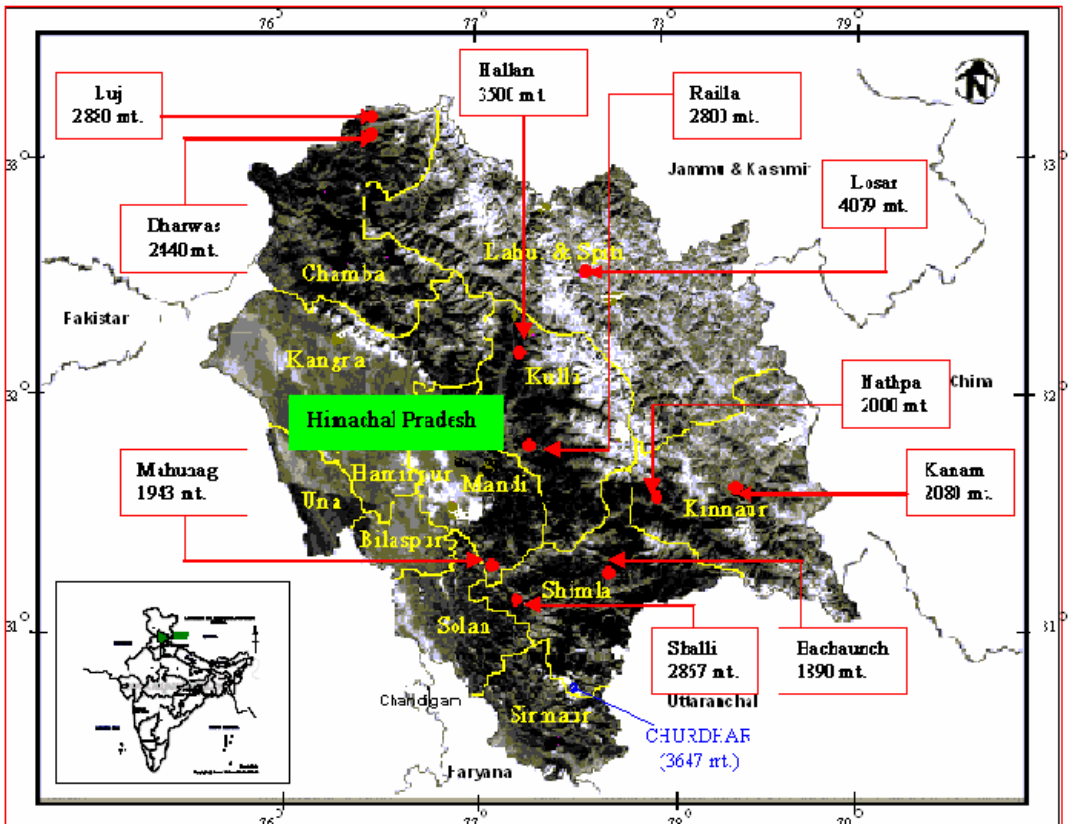

Figure 1. The study area

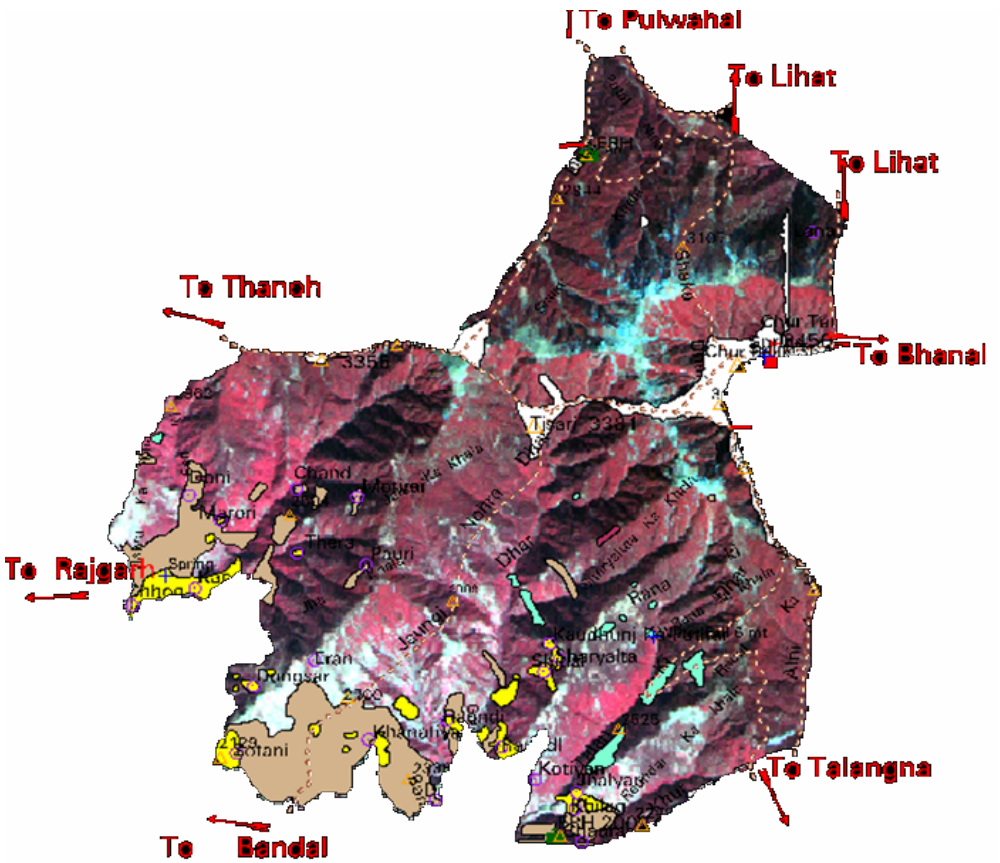

Figure 2. Satellite imagery landscape of Churdhar sanctuary

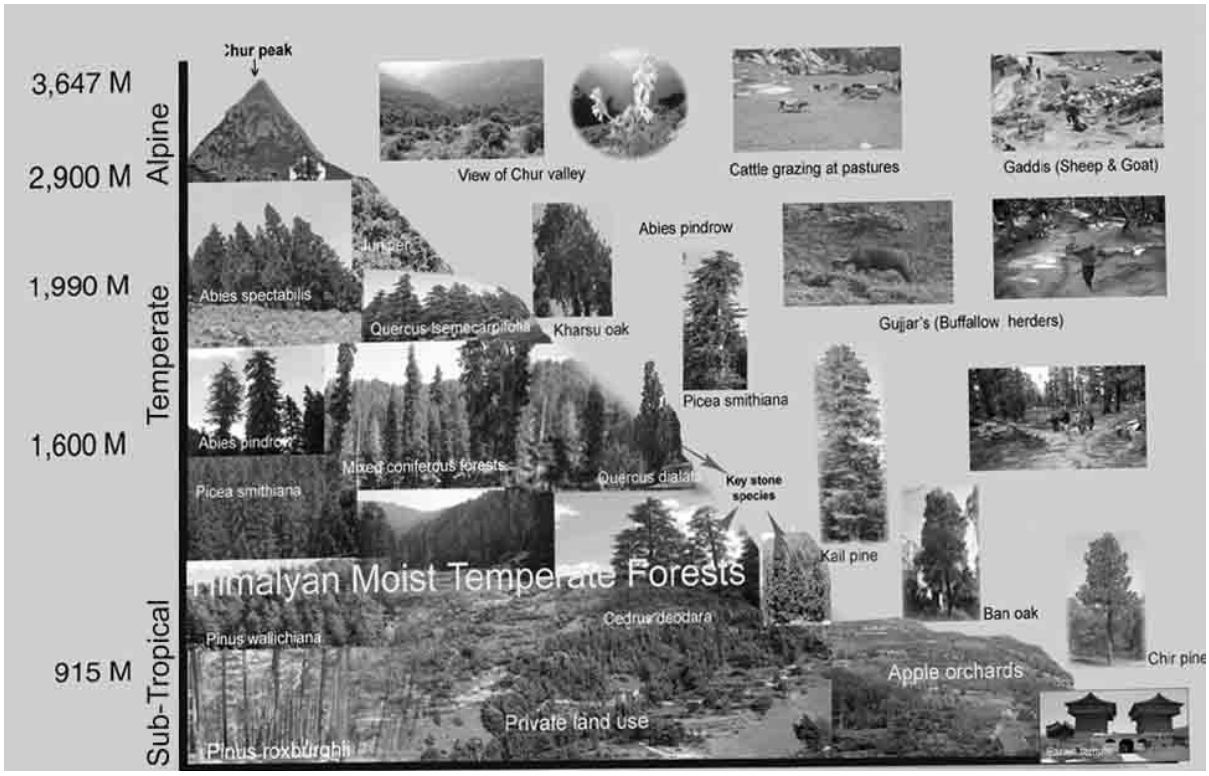

Figure 3. Land use patterns among various ethnic groups in the study area.

Traditional Forest Management approaches and systems

The cultural and religious belief system centered on local deities maintaining temple forests, the sacred species, sacred groves and sacred landscape and combination of economical agro-forest system and keystone species in all agro-ecological zones. There exist inter-village and intra-village arrangements related to the imposition of restrictions on grazing in a particular forest or for a particular period, restrictions on cutting and lopping of trees, division of forest or common land for cutting grass (Gupta 2006). Community and private wood lots are protected at the community level as the area is divided into small block or compartments and each compartments is allotted to the inhabitant for rotational lopping of fodder particularly oaks during winters. Traditional NTFP management of *Acacia catechu (catechin)*, *Pinus roxburghii* for resin, *Acacia nilotica* for tannin and gums and *Grewia optiva* for fodder and fiber and *Pinus gerardiana* cones, morels, black cumin are collected from forest by local inhabitants and are sold in the market for economic remunerations. The state forests of these species are managed by the villagers as commons that are divided into small blocks and each block is allowed to a family for protection management and regulated collection and distribution of produce under the supervision of deity committee (Gupta 2007).

Integrating TFK systems for sustainable forest management

There is a strong positive relationship between social capital and forest protection and conservation at local level and the cultural practices regarding land and resource use. The indigenous knowledge/practices and local institutions complement each other however there are instances of local knowledge and associated practices being evolved yet breaking down at the same time. The social capital facilitating collective action and the related aspects can be enhanced to facilitate better forest management by identifying improvements and policies necessary for sustainable forest management lies in understanding of the contextual causes of forest loss from the local perspective (Gupta 2007). Harmony between people and forests requires forest managers to learn from local resource users by collectively challenging the prevailing received wisdom and negative views on the structural dynamism, policy relevance and scientific validity of local knowledge and institutions in forest resource management.

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KNOWLEDGE INNOVATION IN AGROFORESTRY LANDSCAPE: PARTICIPATORY TECHNOLOGY DEVELOPMENT FOR THE SLOPING LAND CONVERSION PROGRAM IN YUNNAN, SOUTHWEST CHINA

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Introduction

Indigenous Knowledge or traditional knowledge has drawn great attention in the past two decades. Rather than be claimed as barbarous and backwards, contributions of the indigenous people and their knowledge to forest management and biodiversity conservation have been widely recognized by international society and treaty, including UN and Biodiversity Conservation Convention (e.g. Posey & Dutfield 1996). With the call for more utilization and recognition of traditional knowledge at national level, there are also questions about how the knowledge could be innovated in response to this rapid changing world in the recent technical, political and economic context.

In China, in response to the huge flood caused by overflowing of the Yangtze in 1998, the national government had launched the National Forest Protection Program and the Sloping Land Conversion Program aimed to improve upstream watershed of Yangtze and Yellow Rivers. For Sloping Land Conversion Program (SLCP), to reduce erosion and soil loss, and promote more sustainable agriculture, the national government has banned agricultural conversion of forests on slopes exceeding 25°. In contrast, the cultivated slopes should be converted into forest with compensation provided by the central government. However, problems in policy implementation caused a number of social and environmental uncertainties. Mono-culture, prohibition of intercropping, poor seedling, limited options of tree species, lack of technical support, lacking link to market , are the most concerns of scientists in the implementation of Sloping Land Conversion Program.

This paper presents the case from Yunnan, where indigenous knowledge has been promoted for development of an agroforestry model in the Sloping Land Conversion Program. It proves that positive ecological and economic outcome could be achieved by application of Participatory Technology Development approach to improve SLCP. The paper also discusses the significance of indigenous knowledge for both forestry policy formulation and implementation.

Methodology

The approach used in this research, the Participatory Development Technology (PTD), establishes a long term interaction between outsiders and local people, with the aim of generating innovations based on indigenous knowledge and culture to develop sustainable livelihood systems (Salas *et al.* 2003). The PTD involves and links the power and capacities of agricultural research with the interest and knowledge of local communities. The PTD differs from conventional top-down approach to be a participatory farmer-led research so as to be extensively applied in action research in rural development project. The process of PTD is consisted of six major steps: “Getting Started”, “Looking for Things to Try”, “Designing Experiments”, “Trying Things Out”, “Sharing Results”, “Keeping up the Process”. Each of these steps would be assessed by Participatory Monitory and Evaluation.

Results and Discussion

Sloping Land Conversion Program (SLCP) as the most recent forest policy aims to change the land use for watershed protection. The government’s subsidies have provided the incentive for farmers to convert the agriculture land to forest. However, the national government has ignored both local social

and ecological diversity and complexity. To ensure the sloping land to be truly claimed as forest, the government has prohibited the intercropping system, which the indigenous community has practiced for generations. As a result, land has been used in an inefficient manner. The banning of agriculture crop on slopes also constrain the additional income generation before the farmers can benefit from the planted forest. Other problems such as mono-culture, prohibition of intercropping, poor seedling, limited options of tree species, lack of technical support, lacking link to market also limited the positive outcome of SLCP.

By promoting Indigenous knowledge and community participation, therefore, World Agroforestry Centre (ICRAF-China) is promoting agroforestry as a more adaptive approach to the Sloping Land Conversion Program. As the same goal as the SLCP, agroforestry is applied to reduce soil erosion and increase farmers' income. Together with forestry department, ICRAF-China is helping farmers to experiment on domestication of medicinal plants in converted land so as to improve land management and utilization as well as diversify and increase cash income. The medicinal plants were selected for several reasons. First, they are locally collected wild non-timber forest products for commercial use. Second, the resource is becoming more and more scarce as a result of market development and overexploitation. Third, medicinal plants are regard as grass instead of agriculture crop so that the SLCP would allow them to be intercropped with trees. More significantly, the selection has been done by farmers after discussions with forest agencies and ICRAF-China.

At the very beginning, 12 different medicinal plants were selected for the experiment with the consideration of their economic value and knowledge of indigenous community. A farmer interest group has also been formed for the monitoring and evaluation of the experiment. ICRAF-China staff and forest agency take the responsibility for training and facilitation, and monthly meetings were held in the village. Besides, an annual meeting also was held after the harvest. After 3 years, field experiment on the domestication of one of these 12 species, *Dipsacus daliensis* was very successful based on three criteria that farmers' groups defined: biologically domesticatable, economical valuable and manageable for its sustainability in the community. The success of this agroforestry practice has been not only prompted extensive adoptation by the farmers that the plantation has been expanded from the initial area of 0.1 ha to 20 ha in the project community, but more significantly, it has been accepted by the government as a good practice to improve the SLCP.

In conclusion, indigenous knowledge has provided a crucial alternative practice for sustainable agroforestry landscape in current upland management. It can, not only respond to the changing ecological situation, but also adapt to policy transformation. Clearly, the indigenous knowledge is not static, but dynamic. Dynamism of indigenous knowledge reflects a process of Participatory Technology Development (PTD). The PTD approach as an empowerment strategy enables the indigenous community to practice their knowledge in an innovative way. Multi-stakeholders process is the key of PTD to integrate different knowledge systems for local and specific sustainable upland development. PTD, thus, serves as, not only a tool for knowledge innovation and capacity building process, but also a platform for multi-stakeholder interactions and policy reform.

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TRADITIONAL KNOWLEDGE ON FOREST RESOURCE MANAGEMENT BY KASEPUHAN PEOPLE IN THE UPLAND AREA OF WEST JAVA, INDONESIA

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Introduction

Indonesia is also well known as a country of "mega biodiversity," with more than 40 different main ecosystem types compressing more than 400 ethnic group and 500 different local languages. Those cultures and biodiversity can not be separated with the people who live in and area spread out over of the Indonesia archipelago. The Alliance of Indigenous People of the Archipelago (Aliansi Masyarakat Adat Nusantara, AMAN 1999) estimated that 30 to 50 million of total population in Indonesia are indigenous people who still dependent on traditional forests - *Masyarakat Adat*: "people who live in community units bases upon a common ancestry and descent in a traditional/customary territory, who have sovereignty /right over land and natural resources, social and cultural life which is regulated by customary laws, and an indigenous council that oversees the continuation of community life (AMAN's Congress, 1999). Indigenous peoples have very strong motives for protecting their forest resources from destruction. This motivation is based on the belief in inherited rights handed down to them by their ancestors and their awareness that maintaining these resources will guarantee food security, medicine, clean water, building material and other primary resources for sustaining their livelihood. For those indigenous peoples whose lives have already been integrated with the external economy, indigenous forest represents a resource for a number of both timber and non-timber forest products, which have a high value and can be used to provide necessities such as schooling their children, paying taxes, buying vehicle (for faster transportation), televisions and other material goods that they are not able to produce themselves.

Indigenous people in Indonesia possess an indigenous (traditional) knowledge system which is effective in managing natural resources with sustainable. These indigenous knowledge system are the foundation for the variety of different resource management practices and forestry customary law among communities. The customary law (*Hukum Adat*) helps to oversee, organize, strengthen and protect the sustainability of harmonious interactions between indigenous peoples and the forest ecosystem. *Adat* in the Indonesian language means "custom, tradition, manner or the way", and refers to what is now called the "social norms".

This paper addresses the role of traditional wisdom of land use management in the sustainability of natural resources management by comparing the land use management systems of the ethnic groups in West Java with special attention to Kasepuhan living in the Halimun Mountains. The official forest policy of Indonesian governments (central and local) sometimes conflict with customary law of Kasepuhan, which is based on the traditional philosophy respecting the harmony with nature.

Methodology

This research used several methods to collect research data from various sources. The secondary sources of information included documents on the study area which was written by researchers in Halimun area. The primary data were collected through interviews with villagers, questionnaires, focus group discussions and observation. This research involved 150 households in 3 villages inside and surrounding Gunung Halimun National Park – i.e., in Sirnaresmi and Mekarsari villages where the Kasepuhan people are living, and in Malasari village where the local people whose lives depend on the forest ecosystem of the National Park. The comparative study of these forest-based communities

was used to analyze how the philosophy and customary laws of people influence the land use systems and relationships of human with nature.

Results and Discussion

Kasepuhan is one of indigenous communities that has been practicing sustainable forest ecosystem management in the western part of Java Island. These systems incorporate local knowledge and beliefs that are based on the wisdom and experience of past generations. Kasepuhan is an ethnic group of the Sundanese who live in small groups in the Halimun Mountains, the only remaining area on the island of Java with rich biodiversity composed of flora and fauna in tropical rain forest ecosystems.

Philosophy of Life Kasepuhan People

Kasepuhan people live with a traditional philosophy in harmony with nature and have adopted principles that enable them to manage their resources sustainably. Their philosophy is imbedded in the belief that the land and other natural resources being utilized by Kasepuhan people belong to God and as one of God's creatures, human have to protect, use and conserve the natural resources sustainably for the generations to come. This philosophy of life is called "*Tatali Piranti Karuhun*" meaning that Kasepuhan people have to follow, obey, adhere to the secret of life of their ancestor as a moral and ethical way of life. Implementation of this philosophy is not only reflected in their religious aspect but also their social institutions, leadership system and in the management of their natural resources. Figure 1 shows that the philosophy should be applied in their daily life through the relationships between human and God; human and environment; and human and human; humans have to manage these relationship among with their minds, bodies and souls. Kasepuhan people also believe that if they break *Tatali Piranti Karuhun* "*Kabendon"* (misfortune or great disaster) will affect both people who break the rule as well as the community from their ancestor. Kasepuhan people also believe that monitoring and evaluation should be part of their management of life as a reminder to manage their resources sustainably. Once a year, Kasepuhan people conduct an evaluation known as "*Pongokan*" to measure the agricultural yield, including livestock, and observe the factors influencing the productivity of their agricultural products and systems. *Pongokan* is also used to evaluate the population of Kasepuhan including mortality.

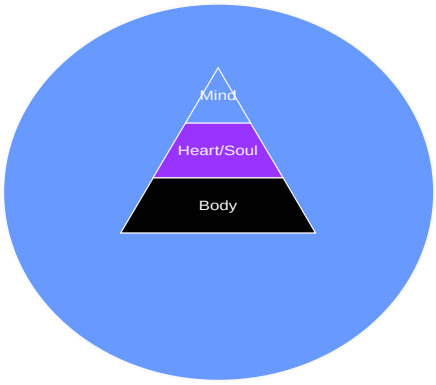

Figure 1. Philosophy of the Kasepuhan People

Customary law on Managing Resources

Related to nature, Kasepuhan people follow great principles and concepts to manage their resources sustainability; Their religious advice is expressed in the Sundanese language as: *"Mipit kudu amit, ngala kudu menta; Nganggo kudu suci, dahar kudu hala; Kalawan ucap kudu sabenerna, mupakat kudu sarerea, Ngahulu kudu ka hukum, nyanghunjar ka nagara"* (Planting must be permitted, harvesting must ask; Using must be pure, Eating must be rightful; Words should be a truth, consensus should be agreed by all member; Role should refer to law; the pillar of their life is state.). The basic principles of Kasepuhan people for managing resources warn them not to allow to resources to be used beyond their carrying capacity. Customary Law is important for applying those principles, and the leader (*"Abah"*) plays a particularly important role to keep and apply these laws.

Their philosophy and principles are reflected in their land resources management systems. Kasepuhans utilize the land and forests surrounding for various uses by adopting different land use models including *sawah* (paddy field), *huma* (swidden cultivation), *talun* (agroforestry garden), *kebon* (garden), and *leuweung* (various types of forests), the scheme of natural management by Kasepuhan can be shown in figure 2. In contrast, the local people at Halimun follow land different use management and do not practice *huma* (swidden cultivation).

Regarding forest management, studies conducted by Harada (2001) and Hendarti (2007) report that Kasepuhans divide forestland into three types: *Leuweung Titipan* (Entrusted Forest), *Leuweung Tutupan* (Closed Forest) and *Leuweung Bukaan* (Open Forest). *Leuweung Titipan* are protected completely without human interference, which maintains the natural forest and functions as conservation and protection forests; these forests play an important role in watershed conservation, but limited non-timber forest product collection is allowed for subsistence. Anyone in the community entering *Leuweung Titipan* and *Leuweung Tutupan* are required to obtain a permission from the leader of Kasepuhan society. *Leuweung Bukaan*, allocated for fulfillment of their livelihood needs, is cultivated as agriculture fields, traditional agroforestry gardens and, timber gardens. Kasepuhan people believe the opening of "*Titipan dan Tutupan*" areas cause damage and loss of habitat for flora and fauna, which eventually means loss for the people themselves. It is understood that the loss of this habitat forces animals living in these forests will go down to the village where they may damage their *kebun, huma, castles*, and that people will lose their necessary sources of water. To maintain these *Titipan dan Tutupan* areas, the Kasepuhan leader has an important role to remind all the followers. This was confirmed through our interviews with the respondents (men and women), who are not allowed access to these forest resources, and the interaction with this forest are confined only to protection and replanting of trees in some areas which were opened or harvested by the State Forest department.

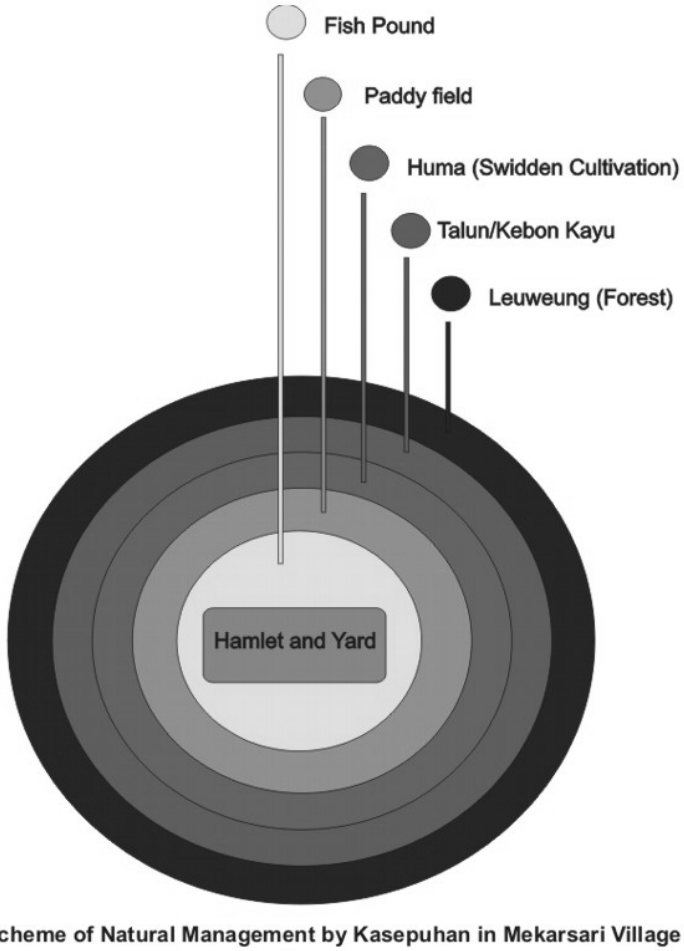

Figure 2. Natural Management by Kasepuhan

To apply their traditional knowledge for managing forest resources, Kasepuhan people have to strengthen their local institutional capacity, although this study also showed that recently, the Kasepuhan are having to deal with internal and external challenges including the disappearance of respect for traditional wisdom. Many traditional ways have been forgotten and have lost the respect of people outside of the Kasepuhan community or even by the Kasepuhan people themselves. For example, some villagers which have lost respect for the sacred forests and now engage in illegal logging, influenced by the middle-men (generally non-Kasepuhan people) who promise them cash money for engaging in this activity. Based on our research, the loss of respect among the younger generation is influenced by the media (TV). Our research showed that 70% of young generation (age 12-17 years) are more interest in working in the city to earn cash income for buying cloth, mobile phones, etc. Threats from external factors include land tenure conflicts due to different perceptions and understandings among the people, and other players (state/government and companies) where areas of the Kasepuhan people are allocated not only for conservation purposes such as national park, but also for other purposes such as mining for gold, silver, and bentonite, and for tea plantation. Meanwhile, the people's settlement area and the area on which people have depended for their livelihoods for generations are labeled as encroachment areas. These are challenges for the future of the Kasepuhan People that deserve further study.

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INDIGENOUS CATECHU PRODUCTION AND SURVIVAL STRATEGIES OF PRODUCERS IN BANGLADESH: A FOREST RESOURCE MANAGEMENT STUDY

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Introduction

The catechu tree (*Acacia catechu* (L.f.) Willd.) is an extremely valuable and productive forest resource supporting the livelihoods of many people. People usually use this forest resource to produce catechu, a crystalline substance extracted from the heartwood, used in chewing betel-leaf. The people of Bangladesh also use this product, locally called *khayer*, to heal the diseases of their cattle, and in small-scale textile production as natural-dye matter. The hidden value and usefulness of its resources is not always apparent; and in most cases, it is not even known to our people. The catechu trees are often cut or destroyed to clear land for cultivation and housing. In this context, the present paper explores the values and ecological utility of catechu and survival strategies of catechu producers in Bangladesh. It concludes with a number of suggested policy recommendations for catechu management with a special focus on the sustainable livelihoods of its producers in Bangladesh.

Methodology

Gopalpur village of Charghat Upazila (sub-district) of Rajshahi District in Northwestern Bangladesh was selected as the study locale for the present research. A considerable number of populations of different villages of this sub-district continue their traditional reliance on catechu production activities which date from the period of British rule in India. The study used social survey, case studies, and focus group discussions to gathering empirical data; other secondary data were also consulted during the studies. The data collection activities were carried out between March 2006 and August 2006.

Results and Discussion

Usefulness of Catechu Trees in the Study Area

In Bangladesh *Acacia catechu* is found principally in Rajshahi, Chapai Nawabganj, Natore and Pabna districts in the northwestern part of the country. The genus Acacia is comprised of over 1200 species, found in tropical and subtropical regions worldwide, with the largest numbers of species occuring in Australia, Africa, and South Asia. About 22 indigenous species of acacia are found in the Indian Sub-continent (Bhatnagar 1948). Catechu is a small to medium sized tree although individuals up to 25 m tall with stem diameters up to 90 cm have been recorded (Watt 1972). The people surveyed in this study reported that they do not engage in planting of catechu, although it regenerates naturally in the forest and around the cultivable land and homestead plots. Its pricky branches are used for fencing their cropping fields and as fuel for cooking and other needs. Traditionally, the rural people of Bangladesh utilize the timber of its trunk for main structural supports for home, for doors and windows, and furniture. The study respondents in Gopalpur chiefly utilize this unique ecological resource for producing semi-solid catechu.

Indigenous Catechu Production Techniques

The catechu producers purchase catechu trees from neighboring villages. For collection, they chiefly depend on the Charghat khayer *hat* (local catechu market) held twice a week at Upazila Head-quarters. The reference rate for catechu logs that produce 1 kg semi-liquid catechu is Taka 120 (US $1.71). The producers themselves and/or hired laborers remove the sapwood around the central heartwood of these logs with an ax. After the removal, the heartwood is chopped into small pieces. The catechu producers set 8 earthen jars on 8 faces of earthen hearth to extract juice from the small chips of catechu heartwood. They then use a square or long rectangular hearth and set a long and flat

korhai (made of CI sheet) on it to heat and thicken extracted juice. The resulting semi-solid catechu substance is stored in earthen jars for sale to local traders of Charghat Bazar. The price of about 35 kg quality *lali kayer* (semi-liquid catechu) is Taka 7000 (US $100). The subsequent processing of *guti kayer* (catechu bar) requires more than 3 months, and is done indoors under electric fans. The local traders reported that 2.5 kg semi-liquid catechu is required to produce 1 kg catechu bar. The reference price for catechu bar of approximately 35 kg is Taka 2100 (US $300).

Labor Involvement

The male and female members of catechu producing households are all involved in the production activities. In some cases, the children also work with their parents. Some producers who have good economic standing employ hired labors.

Survival Strategies of the Catechu Producers

"*Neem tita, nisinda tita, aro tita paner khor* …" (translation: *Neem* is bitter, *nisinda* is bitter, and catechu used in betel leaves is bitterer). In fact, the producers have been experiencing the bitterness of catechu production in their daily life. They have been suffering from lack of technical education and training for profitable catechu production and of adequate supply of catechu logs in the market. Additionally, imported catechu is increasingly used by people in chewing betel nuts and betel leaves. Given this alarming situation, the catechu producing households of Gopalpur formulate and undertake multiple strategies in their own ways to supplement their irregular and meager family incomes from catechu production.

In our study, the inadequate income from catechu production required 88 percent of respondent households to engage their female, child and elderly members in various economic activities to supplement their family income (*cf*. Arens & van Beurden 1977; Islam 2004). Although engagement in economic activities outside the homestead premises by female family members is culturally restricted and considered humiliating for the family, their economic needs compel them to do so. More than 31 percent of respondents have indigenous technical and artistic skills needed for producing handicrafts. The female members produce *kantha* (bed-covers) specially designed using traditional needlework, *pati* (rough mats made of date-leaf), *sheetal pati* (fine mats made of date-leaf), The male members also produce winnowing fans, baskets, *khalpa* (used as wall material and material for homestead fencing), *khalsun* (a means of trapping fish), etc. They make these products for their own household use, and sell them for cash income as well. It was observed that 34 percent of catechu-producing households run some sort of small business for maintaining their family's subsistence. A proportion of them also maintain a store of daily necessaries at their homesteads.

One-third of respondents maintain trees and bushes within their homestead areas. They plant catechu, fruit trees, and trees for timber and fuelwood needs. Their homestead forestry activities contributes to keeping their homestead environmentally sound and provides economic support for family subsistence as well. It is reported that field-level wage labor usually denigrates their social and family status while homestead agriculture is culturally appropriate for catechu-producing women. Almost all respondent households engage their female members in growing vegetables on their homestead. Almost all the responding households are engaged in cattle and poultry-raising activities. Some of them engage in sharecropping with their neighbors and relatives for the production of cattle, chicken and ducks on a fifty-fifty share arrangement.

The field data showed that 14 percent of the total respondents involved in catechu production who had lost capital are impelled to take odd jobs and to sell their manual labor for wages on an irregular basis. Despite all the diverse economic strategies for maintaining their livelihoods in this unsafe economic environment, the catechu producers use *haolat* (a local, interest-free economic loan system), through which cash and/or other daily necessaries are borrowed from their neighbors and/or relatives. Lacking formal organizational support, they follow a principle of reciprocity in times of economic hardship and are very much supportive of each other in their neighborhood.

Concluding Remarks and Policy Recommendations

The catechu producers are highly dependent on traditional catechu-producing knowledge and have been suffering from a lack of technical education, skills and modern tools for their work. Imported catechu is capturing the local market for traditionally produced catechu. Lacking organizational support, they have formulated and adopted multiple corrective rather than preventive alternative

economic survival strategies for subsistence in their traditional fashion. We offer the following policy recommendations to help improve this situation: (i) The traditional catechu producers should be provided with adequate technical education, training and skills, modern tools and machines, exporting facilities, and economic assistance for profitable production in terms of cost, time and labor. (ii) The community people should be socially mobilized to increase awareness of the hidden values of catechu resources for sustainable livelihoods. (iii) Collaboration among natural scientists, social scientists, lawmakers, and policy planners may help to guide the catechu producers in such a way that would be sustainable for their subsistence in the face of economic adversity.

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PROTECTING AFRICA'S RAINFOREST THROUGH THE USE OF INDIGENOUS KNOWLEDGE AND WESTERN TECHNIQUES: EXAMPLES FROM NIGERIA AND GHANA

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Introduction

Contrary to other objects of environmental concern, air or water for instance, the tropical forest does not relate to only two or three specific sectors of life on Earth, health care, food or trade. It involves every aspect of natural and social life. Tropical forests have such a multitude of functions - aesthetic and ecological, economic and cultural, financial and spiritual, scientifically analyzed and irrationally perceived – that the mere mention of them strikes the emotional or intellectual chord in all of us.

Africa's tropical rain forests are facing tremendous development pressure. The vegetation change is linked to population growth, migration and socio-economic development in commerce or technology. In recent years a growing body of literature has been concerned about the role of traditional knowledge (indigenous knowledge – IK) in the management of forest ecosystem. More successful case studies in Africa point to the use of a combination of indigenous knowledge and modern scientific methods in the protection of forest ecosystems.

The farming systems in Africa are difficult to classify because each has its own set of objectives and goals. The agricultural systems are even more difficult to categorize because of environmental factors associated with each. These factors include soil, water, and microclimate. Other factors that complicate the classification problem are biological and socioeconomic in nature. Hence, farming practices appear to be site specific. Nevertheless, a few attempts have been made, by researchers such as Spedding (1975), Morgan and Pugh (1969), Floyd (1969), and Okigbo (1980), to classify the agricultural systems in Africa.

Often connected with the traditional agricultural systems are the fact that the biological systems (biomes) have experienced a long history of clearance and disturbance by man. Unfortunately, there has been a poor understanding of the ecological and economic consequences of such actions. Agricultural systems in many African countries have a long history of tradition and custom. They have survived mainly on the basis of trial and error – often at the expense of the biological systems (Coursey 1976). Haviden (1975), Harris (1976), and Harlan, DeWet, and Stember (1976)(this not listed under references) generally agree that the agricultural systems of many African nations have been greatly influenced by techniques from more advanced nations.

Farming systems in Africa are still evolving because of influences from more technologically advanced nations where mechanized agriculture is practiced. Although mechanization of agriculture has enhanced agricultural production in some African countries, it has also produced some problems. In countries like Sierra Leone, it has been known that the mechanization of rice production increased erosion problems. Other factors contributing to the evolution of the agricultural systems in Africa are population increases, the availability of potential markets, and the demand for food generated by the increase in urbanization (Okigbo 1980). A typical farm in Africa can generally be described as small – about five acres or less. Cultivation is performed with primitive tools and much human labor. Cultivation on a permanent basis is carried out on a compound farm; from these centers of activity merge roads and pathways. An important feature of the compound farm is a series of short-term fallow rotations. Tree crops or a mixture of crop plants are planted in many of these. In Africa, it is not uncommon to find field systems consisting of bush fallows of varying duration. All traditional systems of agriculture make use of the opportunities offered by nature, including topography, rainfall, and microclimate. The main features of African vegetation are forest, grasslands, and deserts. The first two are slowly being converted into the third. What is left in Africa today in terms of forests and savannas is what nature has managed to save despite the abuse and mismanagement of these resources (Kimble 1960).

Methodology

This paper discusses international example in developing countries where traditional knowledge systems and modern scientific methods have been applied in the management of forest ecosystems. The two examples which are discussed in this paper are: 1) between the Government of Ghana and the United States Agency for International Development; and 2) between the Nigerian Government and the United States Agency for International Development. In both cases, the forest management involved the utilization of several kinds of knowledge:

African countries which are rich in forest resources share a lot in common with Asian countries such as India, Nepal, and Bangladesh, in the management practices which are rooted in the knowledge of the indigenous people. By examining various types of indigenous forest and landscape management techniques in Africa and comparing them with those of Asian countries, lessons are learned. In this paper, discussion is provided about indigenous traditions in forestry and the result of the abandonment of the indigenous traditions that lead to the destruction of the forest ecosystems are explained; the history of the traditions is examined in order to put into perspective the significance of the traditional knowledge; the influence of the African traditions in contemporary landscapes of the forest system is tackled; an examination of the benefits from African traditions is undertaken; the distribution of indigenous knowledge and the pay-off and finally the integration of African traditions with modern forestry are explored. Nigerian and Ghanaian examples are discussed in this paper. Common practices of forest management similar to Asian countries are discussed. Ethno-forestry practices such as sacred groves, sacred gardens, and sacred corridors are discussed in this paper.

African farming systems have impacted the forest in many ways, but not as much as the conversion due to large commercial activities. This paper pays particular attention to ecological, economic and societal dimension of indigenous African tradition in forestry matters and issues of empowerment of the African traditional people are thoroughly discussed and examined in this paper.

Results and Discussion

In this paper, the author takes an in-depth look at deforestation in Ghana and Nigeria and discusses solutions through sacred groves and other traditional methods which have helped to protect the forests of Africa. The author summarizes the significance of indigenous knowledge in modern environmental protection. The author argues that understanding the functions of several types of forestry activities in Africa is important to the protection of the forest. The author also concludes that philosophy and religion influence the indigenous way of protecting the forest resources.

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CHALLLENGES IN APPLYING TRADITIONAL FOREST RELATED KNOWLEDGE IN SUSTAINABLE FOREST MANAGEMENT AND POVERTY ALLEVIATION IN MALAYSIA: A CASE STUDY OF A FISH FARMING PROJECT WITH THE JAKUN COMMUNITY IN THE SOUTH-EAST PAHANG PEAT SWAMP PROJECT

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Introduction

The main objective of this paper is to highlight the experiences of a pilot programme that was carried out by the UNDP/GEF Peat Swamp Project in Pahang, Malaysia. The project is a case study for possible application of traditional forest related knowledge in both forest management and poverty alleviation programmes. The alternative livelihood project was carried out between 2006 and 2007, within the southeast Pahang peat swamp forest (SEPPSF). The pilot project involved a fish rearing exercise along the Bebar River.

Methodology

There were several different research on livelihood carried out in the SEPPSF (Savinder 2005; Kamal 2005; Lim 1999). This paper focuses on one research study carried out on livelihood among the *Jakun* community in Runchang between the end of 2004 and early 2005 by Kamal (2005). The approach used was a rapid rural appraisal. Working with a *Jakun* settlement, the research focus was to identify the relationship between the community and the natural environment, and formulate the proposal for a pilot project demonstrating a viable alternative income-generating project. Household incomes and basic information about *Jakun* villages as well as the overall profile of the *Orang Asli* within the SEPPSF were obtained from official sources; primarily from the Department of *Orang Asli* Affairs (JHEOA).

The UNDP/GEF Peat Swamp Forest and Associated Wetland Ecosystems Project

The United Nations Development Programme/Global Environment Facility (UNDP/GEF) funded project on Conservation of Tropical Peat Swamp Forest and Associated Wetland Ecosystems is a Malaysian government initiative, executed through the Ministry of Natural Resources and Environment and implemented by the Forest Research Institute Malaysia. The project is supported by the UNDP/GEF in collaboration with the Danish International Development Agency (DANIDA).

The overall objective of the project seeks to develop and implement plans to ensure the conservation and sustainable use of the Peat Swamp Forest by demonstrating how this can be achieved at three selected sites which exemplify the rich biodiversity of Malaysia's peat swamp forests.

The project covers three peat swamp forest sites; Logan Bunut National Park, Sarawak (10 736 ha); Klias Forest Reserve and the surrounding Bukau Api-Api, Sabah (6100 ha); and the Southeast Pahang Peat Swamp Forests (87 045 ha). The project implementation is primarily supported by the Forestry Departments of Sarawak, Sabah and Pahang.

The Pahang Peat Swamp Forest

The Southeast Pahang Peat Swamp Forest encompasses four permanent forest reserves: Pekan, Kedondong, Nenasi and Resak, with two additional mangrove forest reserves: Sg. Miang and Bebar. The area is bounded in by two major roads from Pekan to Segamat (North/South) and the Tun Abdul Razak Highway that connects a main highway artery to Muadzam Shah Town. Surrounded by palm oil estates, agriculture and logging concessions, the project site is approximately 230,600 ha.

Socio-Economic Profile of the Orang Asli Community in SEPPSF

There are 19 *Orang Asli* villages in the vicinity of the SEPPSF. According to JHEOA, there are currently approximately 2641 families registered in the Pekan district. From this figure, more than two-thirds or 2061 families are listed as poor or hardcore poor, while 491 families are categorized as potentially poor and the balance is regarded as not poor.

Largely in the past, the *Orang Asli* practiced shifting cultivation, hunting, collecting forest products and fishing for their livelihood. Today, they are engaged in a range of traditional and non-traditional activities to meet their needs. Among these activities are harvesting of non-timber forest products (NTFP) commercially as well for subsistence: such as rattan, ferns, orchids, pitcher plants, *Tongkat Ali*, *Pasak Bumi*, *Kacip Fatimah* and many others. They also plant cash crops such as corn, fruit trees, vegetables and rubber trees to generate additional incomes.

Apart from extracting local natural resources, employment opportunities for the *Orang Asli* include working within the timber industry, in palm oil estates, as part of non-skilled work force, etc. It has been observed however that the job opportunities available to members of the *Jakun* community are often seasonal.

Fishing for a living: RPS Runchang Fish Cage Culture Project

Initiating the project

The idea to rear fish in a cage came from the community members who lived and were active in the local fish trade. Their suggestions were that only local fish species were reared because there was demand for these fishes. The requests from the fishermen were for local species such as Tapah, Baung, keli (*Clarias* sp) and puyu (*Anabas* sp) among other fishes.

The pilot project on fish rearing along the peat swamp river introduced formal methods in fish rearing, assisted in monitoring water quality, as well as demonstrated the viability of a sustainable alternative income project by producing a consistent flow of incomes for the project partners. The site for the project was selected after consultation with the Fisheries Department. They recommended the site because it had the necessary depth and was accessible by road.

The project also wanted to build a government/community partnership, to rehabilitate the population of local fish species into the area and to prevent further over-exploitation of native species.

Among the project partners are the Pahang State Fisheries Department, , Pahang State Department of *Orang Asli* Affairs, , Pahang State Forestry Department, and the UNDP/GEF.

Objectives

The primary objective of the alternative livelihood project is to demonstrate the effectiveness of working together with local communities in managing biodiversity. The project aims to protect the economic livelihood of local people who make a living from fishing while taking measures to ensure the continued presence of a healthy population of indigenous fish species. The project seeks “to demonstrate sustainable management of livelihood projects by the local community through cooperation between government agencies and local communities, to help improve livelihood of members of local community most dependent on the Sg. Bebar.” (Gill et al. *in press*)

Specifically, the pilot project aims;

1. To provide a more stable income for people who make a living from exploiting non-timber forest products, especially for people who make a living from fishing,
2. To facilitate partnership between local communities and government agencies.
3. To recognize local communities as stakeholders.

Challenges

The sustainable livelihood Project initiated by the UNDP/GEF Project faced some problems during the implementation stage. Among the common problems faced by the project coordinator are: shortage of manpower; poor attendance for training; poor attendance at meetings; poor participation, especially the youths; no motivation to work for free; the village elites and men tend to dominate decisions on resource management; funding; and ensuring consistent support from partners.

Conclusion

The pilot project remains active and has yielded two batches of fishes for sale after one year. One of the more productive fishermen, working along the river has adopted the method of adapting a makeshift cage to house the young fishes. Growing them to the right size means he is able to demand a higher value for his fishes. In the future he may get involved with rearing from the fish fry. The strength of this pilot project includes:

1. Engaging with local people who utilize local resources and understand how local knowledge works to encourage maintaining a healthy fish population,
2. Support from government agencies as partners
3. The presence of a market structure; e.g. several competing middlemen, consumer demand and accessibility.

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AN OVERVIEW OF LAND USE AND MANAGEMENT IN BALA VILLAGE

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During the past 60 over years (1940-2006), land use patterns in Menghai County has changed a lot, from short rotational shifting cultivation system to permanent system. The changes are as follows: slash-and-burn cultivation to sedentary agriculture (permanent tillage land), to capital construction of agricultural land. The use of agrochemicals: has also evolved from free from chemicals, to light chemicals, to two-chemical-upland, and eventually green/ecological agriculture.

Before 1950, for slash-and-burn cultivation, the fellow period was 13years, due to population pressure, this has been gradually reduced to 7 years and 5-6 years. After Liberation, “Socialist Reform of Agriculture” and “Cooperative Economic Organization in Rural Areas” ended the Feudal Lord’s Land Ownership System. This had led to conflict between new land ownership and the old one, and also the collapse of the slash-and-burn system. In order to respond to the national policies, Menghai encouraged farmers to open up new land and expand crop-production on a large scale at the expense of the rapid decrease of forest.

Before 1953, Bala village and the neighbouring villages grew opium and after that the framers mainly lived on uplands rice. Lake of sufficient food and restrained by the inaccessible road condition, the village moved to the present site and the farmers expanded paddy fields. In 1982, China has begun to carry on “household Responsibility System” and the paddy fields were distributed to each household according to the number of its family members. From 1984, the village expanded the plantation of tea, from 24mu in 1984 to 1500mu in 2005 and the tea has become the main source of cash income. Another key source of cash income from 1993 to 2003 was sugarcane whose plantation areas once reached 2000mu. Because of the continuous declining market and high labor-input as well as a great amount of chemical fertilizer and pesticide used, the farmer cut down the plantation and began to grow maize instead, with the result of the expansion of cattle grazing. In 2004, No.214 national road was constructed and made the village a very accessible place.

Bala Village is one of the most advanced villages among Aka communities in terms of development and changes of land use and production systems. It is a demonstration plot of Menghai county owing to its successful tea Agro-forestry system with diversity of fruit trees. In the village, there is a good combination of traditional agriculture and modern agriculture. For instance, the land management has been done based on traditional as well as modern values: the village-owned forest is not divided into different sectors according to the requirements by the national policy. On the contrary, it is still managed in a traditional way, that is to say, the villagers manage land for agricultural use on communal basis except the paddy fields. The land management in the village can be seen as a SLM model under the traditional and modern leadership and through the local knowledge and modern technology, which is characterized with tea-based agro-forestry system for production and marketing; intercropping of maize, various crops on uplands as an alternative for sugarcane; reconstruction of biodiversity to replace the degrading sugarcane plantation; diversity of maize intercropping and link to livestock production, and reforestation of degraded places by fir trees).

TOWARDS BEST PRACTICES INCORPORATING TRADITIONAL KNOWLEDGE AND WESTERN SCIENCE IN CLAYOQUOT SOUND

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Introduction

Traditional Ecological Knowledge (TEK) can be incorporated into scientific research, for example, in agriculture, pharmacology and ethnobotany. Although TEK does not have a universally accepted definition, there are existing studies in the transmission of TEK (Berkes 1993; Ruddle & Chesterfield 1977), community based TEK research approaches, and environmental philosophy and indigenous knowledge (Lertzman *in press*). The ability to incorporate both TEK and western scientific knowledge into forestry practices and academic research can be challenging and often unsuccessful. However, to demonstrate that we can successfully combine these two knowledge bases, it can be useful to examine a scenario where both traditional knowledge and western science were used. This paper introduces one such case, that of the Nuu-Chah-Nulth of Clayoquot Sound on Vancouver Island, in British Columbia, Canada.

Methods

This study analyzes the Scientific Panel Report according to the OEMXP (ontology, epistemology, morality, exchange, and power) framework to score the Panel's Report against how well it reflected traditional knowledge and western science in its recommendations for sustainable forestry practices in Clayoquot Sound.

The OEMXP framework presents a way to positively score contributions that support successful links between traditional knowledge and western science (Trosper 2006).

Results and Discussion

The Nuu-Chah-Nulth of Clayoquot Sound and the Scientific Panel

Clayoquot Sound encompasses 350 000 ha of land and ocean on the west coast of Vancouver Island, British Columbia, Canada. Clayoquot Sound is covered by ancient temperate rainforest. Five communities – Tofino city and 4 First Nations reserves – in this region, with the First Nations reserves inhabited by Nuu-Chah-Nulth First Nations tribes. In 2005, the total population of Clayoquot Sound was approximately 3000 (Friends of Clayoquot Sound 2006). After environmental NGOs and local communities protested against the logging industry in Clayoquot Sound, the government of British Columbia assembled a scientific body, the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound, whose goal was to develop practical recommendations for sustainable forest management in the area. In order to achieve the goal, the Scientific Panel examined the sustainability of logging practices and also took into account First Nations' perspectives. As a result, the recommendations of the Scientific Panel encouraged environmentally friendly logging practices in the region, so that clear-cut logging was reduced and buffer areas around streams were expanded.

Following the OEMXP framework, it is clear that five categories should be learned and observed during the whole research process. When the evaluating is achieved and participants are "prepared to unpack [their] own values" (Berkes 1999), the forest research and forest management activities that combine western science and traditional knowledge could be successful. This is but the first step towards the recognition of indigenous peoples' reliance on forests, and the Scientific Panel Report successfully addressed the five categories.

Table 1. OEMXP framework

Category	Attention provided the issue	S*
Ontology (Assumptions regarding reality's characteristics)	The Nuu-Chah-Nulth phrase *hishuk ish ts'awalk* ("everything is one") includes sacredness and respect (Atleo 2004). The Nuu-Chah-Nulth phrase *hishuk ish ts'awalk* summarizes a holistic worldview, and has been adopted by the Clayoquot Scientific Panel to describe the ecosystem management approach to forest practice the Panel recommends.	5
Epistemology (Assumption regarding knowledge and learning)	The Panel's report '*First Nations' Perspectives Relating to Forest Practices Standards in Clayoquot Sound'* discusses a variety of culturally important areas, including sacred areas, historic areas, and current use areas. These areas must be determined by the Nuu-Chah-Nulth Nations and protected in ways consistent with traditional knowledge.	5
Morality (How people should behave)	There are right ways and wrong ways to relate to the environment. Although the Scientific Panel only discussed briefly on the Nuu-Chah-Nulth's morality, they fully recognized how people should behave.	4
Exchange (How people make a living and share what is produced; Ownership of the products of knowledge)	The Nuu-Chah-Nulth want to be involved in resource planning, stewardship, and development, and to reap the economic and social benefits of being a full partner in the sustainable use of their traditional territories. However Canadian Government does not recognize the Nuu-Chah-Nulth's ownership of the traditional territory. There is not much for indigenous people's modern work.	2
Power (Who can make decisions for other people; how ideas are legitimated; issues of consent)	Participants were considered to have equal authority in the planning process. Although disagreements among participants did not permit a consensus to be achieved, the Commission on Resources and Environment's approach offers helpful ideas for forest planning processes including a less hierarchical, more an inclusive decision-making process, and encourages the sharing of concerns and ideas among participants	4

S* (Score), 5 (Outstanding), 4 (Excellent), 3 (Good), 2 (Fair), and 1 (Poor)

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CO-MANAGEMENT OF BIODIVERSITY: TRADITIONAL KNOWLEDGE AND FOREST RIGHTS OF THE SOLIGA IN SOUTH INDIA

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Introduction

The Soliga of the in southern Karnataka, India, were shifting cultivators until three decades ago. They were required to settle after the 540-sq km Biligiri Rangaswamy Temple Wildlife Sanctuary was designated (notified) as a protected area under the Indian Wildlife Act 1972. Located at the eastern reaches of the Western Ghats, the sanctuary includes varied climatic and topographical conditions that have resulted in diverse vegetation types, including dry scrub forests, woodland savanna, deciduous forests, evergreen forests, *shola* forests and grasslands. The sanctuary provides habitat for 36 species of mammals and more than 245 species of birds. Formerly shifting cultivators, the Soliga have adapted and settled well as farmers. Labour in coffee estates and harvesting of non-timber forest produce (NTFP) serve as sources of meagre income. The Soliga currently experience insecurities of tenure and resource access due to an official ban on NTFP collection since 2004. Poverty among the Soliga has increased since the ban. The loss of income from NTFP collection has rendered the Soliga vulnerable to health and food security anxieties. Recent evidence suggests widespread depression. A total loss of access to ritual and religious spaces also remains a possibility given the relocation agenda of the Wildlife Department responsible for the management of the sanctuary.

The political ecology of the Biligiri Rangaswamy Betta Temple Wildlife Sanctuary reveals two areas of conflicts. One involves the material aspects of livelihoods including incomes, health and vulnerability that arises from curtailed resource and income access. The other realm of conflict pertains to the cultural ecology of Soliga and involves customary knowledge on farming and NTFP harvest, forest and farm diversity, species invasion, fire dynamics, wildlife behaviour and the ritual configuration of forests, all of which provide the Soliga an normative and knowledge basis for resisting official conservation strategies.

Intervening in conflicts between the Soliga and the Wildlife Department over resource access and recognising the need to maintain and enhance biodiversity values, the ATREE's Conservation and Livelihoods Programme (C&LP) posed the following question: How can biodiversity conservation be reconciled with sustainable exercise of use rights? While the C&LP is convinced that institutional arrangements are necessary, there has been a realisation that the facilitation of institutions must follow a sound and sensitive understanding of local culture. Given constitutional provisions, any institutional arrangement needed to be a decentralised effort entailing a partnership between conservation authorities and legally mandated local governance institutions. The felt need to understand customary forest and farm knowledge and culturally sensitise interventions led to the initiation of our study. The effort coincided with the Recognition of a Forest Rights (henceforth RFRA) legislation that vests individual and community forest rights and stipulates conservation duties (The Ministry of Law and Justice, 2007) .

Interfaces between Cultural Ecology and Forest Rights Policy: Methods of Data Collection and Analysis

To gain an understanding of Soliga cultural ecology, fieldwork was initiated. Key informants were identified and oral histories recorded, and inventories were conducted of farm and forest species and observations made of productive activity on farms and in forests. In-depth interviews were conducted with identified members of each clan. Workshops to understand the fivefold kinship structure (Morab, 1977) and its relationship with the *Nyaya Samithi* (customary justice council) were conducted with

clan elders including office bearers of the Nyaya councils. The RFRA was analysed for its institutional and conflict resolution potential. After a close reading of relevant provisions, the Act was communicated and discussed with Soliga elders of each clan, office bearers of the Nyaya council and members of a local community organization. An initial sense of individual and community rights, evidences required for claiming rights, and co-management strategies as provided for in the Act were gained from community members who in groups discussed and mapped such rights, evidences and strategies. Ethnographic information was examined in relation to relevant provisions of the RFRA such as 'evidences' for rights (Section 31, RFRA Draft Rules, 2007) and the stipulations of conservation and protection 'duties' to rights holders and their local institutions (Section 5, RFRA, 2007). Soliga customary practice and theory including those pertaining to institutional and social norms were examined in the context of evidences required to gain individual and community rights. Such practice and theory also served as a customary corpus from which implications and inferences can be drawn for institutionalising the 'duties' clause of the RFRA.

Forest Legislation and Cultural Entitlements- A Summary of Analysis

The 'customary corpus' generated through fieldwork actually finds legal sanction in the RFRA Draft Rules. Amidst 14 documentary and oral evidences privileged for claiming rights is '*prior research or documentation of reputed institutions or individuals including reports, publication of anthropologists and reports of the Anthropological Survey of India'* (Section 31 (g) of Draft Rules). Further through our field and policy engagements with the Soliga we realise that they also possess a wider repertoire of oral, legal, physical and documentary evidences privileged under the RFRA.

The following is a summary of how Soliga moral economy, customary institutions and norms fare under the 'Duties of holders of forest rights' clause of the RFRA (Section 5). The clause '*empowers' right holders and Gram Sabhas to protect biodiversity, and ensure the preservation of their habitats against destructive practice that affects their cultural and natural heritage* (Section 24(a) of the Draft Rules) requires that plans, norms, methods and procedures be prepared for protection and management of community forest resources and that these be harmonised with official prescriptions and plans. Norms for protection, regulation and sustainable use are required to be institutionalised (Section 24 (b) of Draft Rules). So are norms for community wildlife management (Section 24 (c) of Draft Rules).

The Soliga have evolved norms or standards pertinent to both their Nyaya council and their everyday lives. The council operates at village and pan-village scales. Each council is composed of five office bearers with respective decision making, communication and organizing roles. As social control mechanisms the council imposes fines and in the rare occasion passes ostracization decrees. Besides such ethno-legal standards there are everyday obligation and reciprocity standards that constitute Soliga moral economy. Depth and focus group discussions reveal that the council and Soliga moral economy continue to hold normative potential. The moral economy signals a subsistence ethic - production for self consumption and distribution to neighbouring families in distress. This ethic has sustainability overtones in terms of consumption. The moral economy of the Soliga combined with their conviction about the council's role in enforcing norms for forest protection generally, display potential for the institutionalised management arrangements envisaged under the RFRA.

Besides such institutional prospects, there is an ethnic epistemology that has theories for the most pressing conservation concerns in the Biligiri Rangaswamy Betta Temple Wildlife Sanctuary, which is the widespread presence of the invasive weed *Lantana camara* and seasonal fires. The Soliga claim that the curtailment of their historical practice of setting litter fires has created conditions conducive to the spread of Lantana. The practice of litter burning cannot be revived now given the substantial undergrowth of Lantana that can trigger larger uncontrollable fires. With regard to seasonal fires which the Wildlife Department considers as incendiary events and consequently as forest offences, the Soligas attribute these to carelessness by outsiders and natural causes such as lightening.

However there is no collective claim that such customary knowledge and institutions replace forestry science and law. But there is common sentiment and claim that such alternatives be accommodated and incorporated. It is our understanding that despite an insecurity of tenure the Soligas reveal strong cultural stakes in conserving forests. They also possess historical and practical knowledge of forest dynamics. The institutional space for ensuring and building of Soliga stakes in conservation and accommodating their knowledge has emerged through the RFRA. Once the Act is gazetted the onus would lie with the Wildlife Department to engage progressively with this new phase of co-management.

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TRADITIONAL FOREST-RELATED KNOWLEDGE AND THE CURRENT INTERNATIONAL FOREST POLICY

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Introduction

Traditional Forest-related Knowledge (TFRK) contains lots of useful information about forests and helps to use and manage forests sustainably. Many groups of indigenous and local people can survive in hard conditions only due to such knowledge that had been inherited from previous generations. Currently such knowledge disappears very fast and it is important to preserve it. TFRK has been discussed in many political processes. The most important processes for negotiations on international forest are the United Nations Forum on Forests (UNFF) and UN Convention on Biological Diversity (CBD).

Results and Discussion

TFRK at IPF/IFF/UNFF: obstacles for implementation.

TFRK was extensively discussed during the processes of Intergovernmental Panel on Forests (IPF) and Intergovernmental Forum on Forests (IFF) during the years from 1995 till 2000. Dozens of good conclusions and proposals for action on TFRK were developed during those global processes. These conclusions and proposals for action are related to the following issues: participation of holders of TFRK in the development of national forest programmes and policies, use of TFRK for conservation and sustainable forest management, capacity building, technology transfer, etc. Many representatives from NGOs, Indigenous Peoples, Scientific Communities, and other major groups as identified in Agenda 21, had actively contributed in the development of IPF and IFF proposals for action. These major groups organized inter-sessional discussions about TFRK and other relevant issues in Leticia (Columbia) in 1996 and adopted the so called Leticia Declaration. Outcomes of Leticia meeting gave a basis for IPF proposals for action on TFRK. Unfortunately IPF/IFF proposals for action on TFRK were not implemented although they were adopted many years ago. There is no political will of governments to take this issue seriously. Although there are not enough capacities in many developing countries, implementation of TFRK is not included in the priority lists of most donor agencies.

UNFF was established in 2000 and continued the IPF/IFF process of developing international forest policy. Social and cultural issues of forest policy were discussed during UNFF-4 in 2004 in Geneva, Switzerland. Unfortunately common resolution on TFRK was not adopted by UNFF-4. After that failure major groups organized another inter-sessional discussion on TFRK in San Jose (Costa Rica) end of 2004. There were lots of useful recommendations for the upcoming sessions of UNFF and CBD (these UN Agencies were co-sponsors of that meeting). But the following sessions of the UNFF (from the fifth to the seventh) did not pay much attention to the issue of TFRK.

The main reason for this is the highly politicized agenda of the UNFF process. All decisions are adopted by diplomats or politicians. Unfortunately not many forest experts participated in UNFF meetings and those experts who participated could not influence the decisions adopted by the diplomats.

UNFF-7 which took place in New York in April 2007had developed a non-legally binding instrument for all types of forests (NLBI) and a multi-year programme of work for 2007-2015. The NLBI was finally approved by the UN General Assembly in 17 December 2007.

The following principles of the NLBI are relevant to the TFRK issue:

- The instrument is voluntary and non-legally binding.

- Each State is responsible for the sustainable management of its forests and for the enforcement of its forest-related laws.

- Major groups as identified in Agenda 21, local communities, forest owners and other relevant stakeholders contribute to achieving sustainable forest management and should be involved in a transparent and participatory way in forest decision-making processes that affect them, as well as in implementing sustainable forest management, in accordance with national legislation.

According to the multi-year programme of work, UNFF will discuss issues on "Forests for people, livelihoods and poverty eradication" (including TFRK) at its ninth session in 2011. Also UNFF proposed, and the UN General Assembly agreed, that 2011 will be the International Year of Forests. So scientific community, Indigenous Peoples, NGOs and other major groups should efficiently use that opportunity to propose relevant recommendations to UNFF-9. The State of Knowledge report and other outcomes of the IUFRO Task Force on TFRK that will be published in 2010 can give useful basis for such recommendations. But because UNFF is not a legally binding process, effectiveness of its decisions would not be satisfactory and would depend on the political will of national governments.

TFRK in the Convention on Biological Diversity (CBD).

While UNFF is not legally binding process, CBD is the legally binding one. In the CBD agenda TFRK is more developed than inside UNFF. Article 8(j) (adopted in 2000) and the expanded programme of work on forest biological diversity (adopted in 2002) make direct references to TFRK inside the CBD.

CBD Article 8(j) is named: Traditional Knowledge, Innovations and Practices. Article 8(j) states:

> "Each contracting Party shall … respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices".

Major elements in the current biennial programme of work (2006-2008) include (among others) developing indicators for the retention of traditional knowledge and methods and measures to address the underlying causes of the loss of such knowledge.

The expanded program of work on forest biological diversity consists from 3 Program Elements, 12 Goals, 27 Objectives and 130 Activities. TFRK are mentioned in the following paragraphs of Activities:

Programme Element 1: Conservation, Sustainable Use and Benefit-Sharing

Goal 4: To promote the sustainable use of forest biological diversity

Objective 1: Promote sustainable use of forest resources to enhance the conservation of forest biological diversity

Activities: a) Support activities of indigenous and local communities ***involving the use of traditional forest-related knowledge in biodiversity management***.

Objective 3: Enable indigenous and local communities to develop and implement adaptive community-management systems to conserve and sustainably use forest biological diversity.

Activities: c). Encourage the conservation and sustainable use of forest biological diversity by indigenous and local communities through their development of adaptive management practices, using as appropriate ***traditional forest-related knowledge***;

f). Create an environment that fosters respect, and stimulates, preserves and maintains ***traditional knowledge related to forest biological diversity, innovations and practices of indigenous and local communities.***

Programme Element 2: Institutional and Socio-Economic Enabling Environment

Goal 3: Increase public education, participation, and awareness.

Objective 1: Increase public support and understanding of the value of forest biological diversity and its goods and services at all levels.

Activities: c) Increase awareness amongst all stakeholders of the ***potential contributions of traditional forest-related knowledge to conservation and sustainable use of forest biological diversity***.

f). Implement effective measures ***to recognize, respect, protect and maintain traditional forest-related knowledge*** and values in forest-related laws and forest planning tools, in accordance with Article 8(j) and related provisions of the Convention on Biological Diversity.

Programme Element 3: Knowledge, Assessment and Monitoring

Goal 2: Improve knowledge on, and methods for, the assessment of the status and trends of forest biological diversity, based on available information

Objective 1: Advance the development and implementation of international, regional and national criteria and indicators …

Activities: b). Develop and select international, regional and national criteria and … indicators for forest biological diversity, taking into account … existing work and processes on criteria and indicators on sustainable forest management, as well as ***the knowledge held by indigenous and local communities***.

The next (ninth) session of the CBD COP will discuss implementation of the expanded work programme on forest biological diversity including all issues concerning TFRK. Global Forest Coalition (NGO with headquarters in the Netherlands and in Paraguay) organized Independent Monitoring of implementation of the expanded work programme on forest biological diversity in 20 countries from all continents. The final outcomes of the Independent Monitoring of implementation of the expanded work programme on forest biological diversity in 20 countries will be reported in the COP-9 of CBD in May 2008 in Germany. The following preliminary conclusions are made on the issues concerning TFRK:

1. The current forestry paradigm continues to be the key source of knowledge and guidance at all academic and training levels. There were no cases reported on work related to alternative forest or forestry knowledge. The consequences of this fact for the implementation of the CBD/POW are very serious, as the rich cumulus of knowledge that Indigenous Peoples and women hold would, that way, remain unutilized.
2. In only two of the countries monitored the governments have involved Indigenous Peoples in the implementation, though indirect, of clauses related to the CBD/POW, such as conservation and sustainable forest management and traditional knowledge.

So in spite of the importance of the TFRK issues for forest peoples and biodiversity, it can be concluded that governments do not pay much attention to the protection of TFRK, or the implementation of the CBD Article 8 (j) and the expanded programme of work on forest biological diversity. It is recommended that governments, together with major groups, take serious steps on implementation of national forest and biodiversity programmes including issues concerning TFRK and rights of Indigenous Peoples and local communities.

UTILIZATION OF MACROFUNGI BY SOME INDIGENOUS COMMUNITIES FOR FOOD AND MEDICINE IN PENINSULAR MALAYSIA

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Introduction

There are over 94 different groups of indigenous people in Malaysia, each with their own distinct language and culture, with the majority being found in the states of Sabah and Sarawak on the island of Borneo. The indigenous people of Peninsular Malaysia, collectively called the *Orang Asli*, are composed of 18 sub-ethnic groups classified under the three major tribes of the Negrito, Senoi and Proto-Malays (JHEOA 2003), with a population of 149 512 persons in 2004 (Nicholas & Baer 2007). Traditionally the *Orang Asli* lived in and subsisted on the forests, but increasing loss of forest areas plus integration into mainstream society and urbanization, are leading to the rapid loss of their traditional knowledge and culture. In an effort to record some of this precious indigenous knowledge, a questionnaire survey was conducted with selected indigenous communities in several states in the Peninsular Malaysia to document the macrofungi utilised for food and medicine and to identify fungi with potential for cultivation and commercialization.

Methodology

The communities and villages surveyed were identified based on distribution, accessibility and the recommendation of officials from the Department of Orang Asli Affairs (JHEOA). The survey was conducted through formatted interviews of individuals using a specially prepared questionnaire and colour illustrated fungal guide. Wherever possible during the survey, samples of fungi utilized by the local communities were photographed and collected and any additional information or data not covered by the questionnaire recorded.

All visits to the selected communities were made together with officials of the JHEOA. At each village the *Tok Batin* or head of the community or village was interviewed, as he is usually the most knowledgeable and respected person in the village. Wherever possible, prior notice of the visits was given through officials of the JHEOA and villagers were requested to bring samples of macrofungi that they utilised for the interview.

Results and Discussion

It was not possible to include villages representing all the 18 *Orang Asli* sub-tribes from Peninsular Malaysia in the survey as some communities are nomadic while others are not easily accessible. Visits were made to 70 villages, the majority of which were Semai in the states of Pahang, Perak and Selangor (Table 1). The Semai are the largest community of *Orang Asli* in Peninsular Malaysia while the Che Wong among the smallest (JHEOA 2003).

At least 40 species of macrofungi were considered edible but only 23 species were used for medicinal purposes (Table 2). No single species was unanimously identified as being edible or medicinal by the 70 villages surveyed. More than 50% of respondents identified the following species as edible: *Auricularia* sp., *Clavulina* sp., *Schizophyllum commune*, *Termitomyces microcarpus* and *Termitomyces* sp. Some species generally considered edible by most villagers and known by the authors as edible were surprisingly considered poisonous by some, e.g. *Auricularia* sp., *Cantharellus* sp., *Clavulina* sp., *Hygrocybe conica*, *Lentinus* cf. *sajor caju* and *Lentinus squarrusolus*. *Amanita tjibodensis* and *Dictyophora indusiata* were considered by all respondents to be poisonous although the latter is widely consumed and highly prized by the Chinese. A booklet on 12 common edible

mushrooms utilized by the *Orang Asli* communities in Peninsular Malaysia has been published (Lee *et al.* 2006) and distributed to all the communities surveyed as well as to the JHEOA.

Table 1. Number of villages and communities surveyed in the states of Pahang, Perak and Selangor, Peninsular Malaysia.

Sub-tribe	**Pahang**	**Perak**	**Selangor**	**Total**
Semai	31	16	0	47
Temuan	4	0	8	12
Che Wong	2	0	0	2
Jakun	6	0	0	6
Bateq	3	0	0	3
Total	46	16	8	70

Knowledge about the utilization of the various species of fungi varied greatly between villages and sub-tribes. The Semai were generally most knowledgeable about macrofungi utilization, recognizing at least 37 types of edible fungi followed by the Temuan (24), Jakun (23), Bateq (14) and Che Wong (8). Reasons for this are unclear. Fungi were collected for the communities' own consumption and not for commercial purposes, with the exception of *Lignosus* sp.(susu rimau) which is specifically sought for upon request by urban middlemen, mostly local herbalists. *Orang Asli* uses of some medicinal mushrooms have been discussed by Chang *et al.* (2005).

As the women are generally the ones who tend the fields and gather food from the forest, they are also the ones who collect the fungi. Trips are not made specifically to collect fungi. Thus it was not surprising that during our interviews with the headmen of the villages, the women folk usually joined in the interviews, providing much of the information. Generally the younger generation, especially the men, were much less knowledgeable and less interested to learn about macrofungi utilization. In the villages traditional knowledge including the utilization of mushrooms is passed down orally within the communities, with the women playing an important role in this tradition.

Collections of fresh specimens together with the *Orang Asli* need to be made to confirm the results of the surveys which have been largely based on interviews and the use of an illustrated guide. Surveys also need to be extended to other tribes so as to obtain a better understanding of *Orang Asli* utilization of macrofungi for food and medicine in Peninsular Malaysia.

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Table 2. Macrofungi utilized for food and/or medicine by the Semai, Temuan, Che Wong, Jakun and Bateq of Peninsular Malaysia. Numbers in the columns indicate the number of villages utilizing the fungus.

Fungus	Edible	Medicinal	Poisonous
Amanita angustilamellata	1	0	7
Amanita hemibapha ssp. *similis*	17	0	12
Amanita princeps	3	0	9
Amanita tjibodensis	0	0	12
Amauroderma sp.	0	5	0
Amauroderma subresinosum	12	3	3
Auricularia sp.	49	0	3
Biscogniauxia sp.	2	1	3
Boletus aureomycelinus	6	1	8
Calvatia sp.	2	0	27
Cantharellus sp.	20	0	4
Clavulina sp.	39	1	5
Clitopilus cf. *orientalis*	11	1	4
Cookeina sulcipes	6	7	11
Coriolus versicolor	1	2	12
Coriolus hirsutus	1	5	15
Craterellus cornucopioides v. *mediosporus*	2	0	7
Cymatoderma sp.	5	0	4
Dacryopinax spathularia	2	0	4
Daldinia concentrica	2	7	25
Dictyophora indusiata	0	0	45
Geastrum sp.	1	0	34
Hygrocybe conica	28	2	3
Lactarius gerardii	3	1	6
Laetiporus sulphureus	3	0	12
Lentinus cf. *sajor caju*	26	2	1
Lentinus squarrusolus	32	0	5
Lenzites acutus	4	0	6
Lenzites vespaceus	3	0	3
Lignosus sp.	1	52	1
Macrocybe/Lyophyllum	28	1	7
Microporus xanthopus	0	15	17
Neurospora sp.	1	0	0
Panus giganteus	17	0	11
Phellinus sp.	1	4	6

Pulveroboletus icterinus	0	1	7
Pycnoporus sanguineus	4	14	13
Russula sp.	13	5	9
Scleroderma sp.	12	3	21
Schizophyllum commune	58	0	0
Termitomyces microcarpus	48	0	0
Termitomyces sp.	47	0	0
Thelephora cf. *fuscella*	0	2	6
Tremella fuciformis	16	0	9
Volvariella sp.	14	0	4
Xylaria polymorpha	0	24	9

BUILDING ON TRADITIONAL SHIFTING CULTIVATION FOR ROTATIONAL AGROFORESTRY: EXPERIENCES FROM YUNNAN, CHINA

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Introduction

Traditional shifting cultivation in the tropics integrates a relatively short cropping phase and a relatively long forest fallowing phase as a rotational system in space and time. The cropping phase mixes a variety of crops (cereals, root crops, vegetables, etc.), and ensuring a balanced food supplies for shifting cultivators (Yin 2001). The fallowing phase is essential to help restore soil fertility lost during the preceding cropping phase. Forests in the fallowing phase not only produce wood and non-wood forest products, but also contribute nutrient inputs to soil through uptake from deep soil horizons and nitrogen fixation, improve soil conditions, control weeds, and check runoff and soil erosion for the succeeding cropping phase. Moreover, both the cropping phase and the forest fallowing phase host rich biodiversity, including crop diversity. Over centuries, shifting cultivators have created and accumulated profound knowledge on cropping as well as forest management.

However, the traditional shifting cultivation is under external and internal pressures to change. Forest lands are increasingly taken away for nature conservation, timber extraction and other uses. The forest lands available to shifting cultivation are shrinking. The population growth and social changes also put increasing pressure on shifting cultivation to produce more on less land. If one considers the cropping phase as the only production period to meet the rising demand, the intensification pressure would result in extension of the cropping phase and shortening of the fallowing phase. The shortened phase of fallowing would not allow forests to recover sufficiently for restoration of soil fertility and controlling of weeds. The productivity of the succeeding cropping phase would decline. It was reported that the forest can not recover if the length of the fallowing phase is shorter than 10 years in Northeast India (Ramakrishnan 2006). The shortening of the fallow phase below 10 years has led to succession of weeds and land degradation there.

Realizing the negative consequences of the shortening of the fallowing phase, sedentary agriculture (continuous cropping in the same fields and without fallowing) is often promoted as an alternative to replace and discourage the shortened shifting cultivation. The sedentary system would lose multiple benefits arising from the forest fallow, including soil fertility restoration as well as production of forest products. Moreover, the traditional culture and crop genetic resources associated with shifting cultivation would be also lost. There is a challenge to develop a new land use system that would continue to make use of the logic of traditional shifting cultivation.

This paper looks at how some indigenous peoples in Yunnan Province hybridize elements of the traditional shifting cultivation and the new agriculture and forestry technologies for a new and dynamic rotational agroforestry system. The paper will also discuss conditions, including policy and market, that enable emergence of the hybrid system in some parts of Yunnan Province, China.

Methodology

The focal area of this study is located in the southwestern region of Yunnan Province of China, including Dehong Prefecture and Tengcong county of Baoshan Prefecture bordering Myanmar on the west. In spite of altitudinal zonation, a sub-tropical monsoon climate prevails, with the dry season from November to April and the rainy season from May to October, in the region. The rainfall is high, ranging from 1400 to 1900 mm per annum. The topography is mostly mountainous with an average

altitude of around 1000 to 2000 m. Between the mountainous ranges are narrow alluvial plains. While the mountains are mostly covered by forests, the alluvial plains are largely converted into the productive wet fields for rice production, urban centers and other infrastructural uses. Ethnic minority groups of Jingpo, De-Aang, and Lisu, live in the mountainous areas of the region. With limited land suitable for wet rice fields in the hilly areas, these minority groups practice shifting cultivation for production of upland rice as the staple food. Over centuries, some shifting cultivators of this region, have created a unique practice in which they mix seeds of upland rice with seeds of alder (*Alnus nepalensis*) and sow the mixture in the newly opened fields during the cropping phase (Yin 2001). After harvesting of upland rice, the intercropped alder trees will continue to grow during the fallowing phase. The alder trees have a symbiosis with nitrogen-fixing actinomycetes and grow fast for accelerated recovery of soil fertility. Like other parts of the country under shifting cultivation, this region has been under increasing pressures both external and internal to adapt, such as rapid growth of population and economy. However, the forest coverage of the region remains high, 70% in Dehong Prefecture and 65% in Tengcong County. The adaptation of the traditional shifting cultivation seems successful with regard to forest resources.

This research is based on long-term field observations by the two co-authors on the changes of the shifting cultivation areas in the region. One co-author lives in the region and used to be responsible for technical support for the reforestation programme in Dehong Prefecture. Another co-author used to live in the region and has made frequent visits to the region for relevant research projects and supervision of his Master of Science students to look at adaptation of shifting cultivation in the region (Shiro *et al*. 2007 & Tan *et al*. 2007). Two of the co-authors jointly investigated the unique practice of upland rice-alder rotational system and its evolution in Tengcong County by discussions with local officials and farmers in August 2003 to identify a candidate system of traditional shifting cultivation for the FAO Initiative on Globally Important Agricultural Heritage Systems (GIAHS) (Shen *et al*. 2007). The three co-authors conducted a joint field investigation on adaptation of the shifting cultivation in the region in December 2005. A workshop was then organized through Dehong Forestry Association with participation of 30 local forest researchers and officials from all the counties of Dehong Prefecture, from 5 to 7 July 2007, to solicit an overview of the adaptations in shifting cultivation and their impacts in the region.

Results and Discussion

Shifting Cultivation in Transition

The general trend is that traditional and unique practice of upland rice-alder tree rotation has been inherited, developed and combined with some elements of new technologies. Indigenous farmers continue the traditional principle of crop-tree rotation, but adopt new crops such as maize, soybeans, peanuts, pineapples and new timber trees, such as *Pinus yunnanensis*, *Taiwania flousiana, Cunninghamia lanceolatq, Betula alnoides* in the rotation system. There are many combinations of crops and trees. The fallowing phase is largely becoming a phase of production of timber species highly valued by the booming market. Young tree seedlings are growing among upland rice, maize, or pineapple fields. Such a rotational agroforestry system is widely practiced in the former shifting cultivation areas in the region.

Farmers explained that cropping in the new rotational system continues for 2-3 years in order to remove weeds and look after the tree seedlings. The food crops between tree seedlings produce short-term benefits, but also provide necessary shade for young tree seedlings, control weeds and increase ground cover. The crop residuals are used as green manure to support growth of tree seedlings. Farmers will stop planting food crops once the trees had shaded out light to food crops on the ground. The management during the fallowing phase has become intensive. There are active control of forest pest and fire, and pruning, and selective cutting/thinning to improve tree growth. Some farmers cultivate *Amomum tsaoko* and *Dendrobium nobile*, etc. under the forest canopy. This practice of cultivation under forest canopy may limit grazing of livestock in the forests.

After harvesting of timber, farmers will burn the residual litter, plant crops first and plant tree seedlings later. The tree seedlings are prepared in farmers' own nurseries or purchased from market and then planted in small pits dug among food crops. The technique of tree planting is different from the traditional way of sowing alder seeds mixed with upland rice seeds. Selection of timber species depends on availability and market value. Recently, forestry researchers have succeeded propagation of seedlings of *Betula alnoides*, an indigenous and valuable timber species. The *Cunninghamia lanceolatq* based rotational system may also depend on new shoots to regenerate.

Benefits of the New Rotational Agroforestry System

The rotational agroforestry systems inherits the logic of traditional shifting cultivation, integrating production of food and forest products, and ecosystem services (soil restoration, control of weeds and erosion, carbon sequestration in forests) in time. Moreover, the economic productivity has been greatly improved with adoption of new crops and valuable timber species, and management of timber species. For example, pineapple-tree rotational system produces pineapple for 2-3 years with yearly average income of RMB 20 000 per ha. The timber trees (such as *Betula alnoides*) can be harvested after 20 years of growth. The average value of timber amounts to RMB 100 000-225, 000 per ha. On average the annual income of the system, including sale of pineapple and timber, is RMB 7 500-14,250 per ha, which is 10 times the value of the agricultural cropping without timber production (Yang 2006). Many farmers are able to purchase sufficient rice on the market with the income from sale of timber and non-timber forest products. They do not have to shorten the fallowing phase, at the expense of land degradation, for increased food production. In fact, the fallowing phase for timber production remains long, from 10 to 20 years.

Factors Contributing to Development of the Rotational Agroforestry System

Several factors have facilitated development and extension of the rotational system. First, natural conditions in the region, such as subtropical monsoon climate and abundant hilly areas are unsuitable for permanent cultivation, but good for agroforestry. Second, farmers have been planting alder trees in the traditional shifting cultivation. It is natural and relatively easy to switch to planting of valuable timber trees in the rotational system. Third, local researchers are actively developing and demonstrating different kinds of rotational systems, especially supporting propagation of tree seedlings of high value. Fourth, the booming market for timber from the region also creates tangible return to timber production. Fifth, the government programme has been supporting reforestation since the 1960's. Recently, the government programme has paid more attention to production and domestication of valuable and rare timber species, especially local species, such as *Taiwania flousiana, and Betula alnoides*. The recent programme to convert the marginal farmland into forests provides additional support to tree plantation in the region.

The new rotational agroforestry system combines crop production and forest management to provide multiple and profitable products is expanding rapidly in the region. It avoids the shortening of the fallowing phase and reduces land degradation. In addition to the rotational system, local farmers have also developed a variety of agroforestry gardens using valuable non-timber perennial crops, such as tea, sugarcane, *Illicium verum, Zanthoxylum bungeanum, Amomum tsaoko,* etc.

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ENHANCING THE VALUE OF FOREST TRADITIONAL KNOWLEDGE THROUGH FOREST CERTIFICATION

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Introduction

Even though the local communities, within and at the fringes of forests, have been using forest resources for a long time, the value of their traditional forest-related knowledge (TFRK) has not been appropriately appreciated. In fact, in the process of modernization and development, changes are occurring within the local communities resulting in erosion of TFRK and the subsequent loss of local culture and traditional practices.

In recent years, there has been increasing worldwide awareness that there is high value in TFRK. On the commercial side, it is now realized that local accumulated TFRK could be further enhanced for modern application in medicinal, pharmaceutical, bio-technological and cosmetic industries. The modern use of TFRK could lead to national income generation and improvement of local economic well-being of the targeted communities through the establishment of benefit-sharing mechanisms. On the social front, the emphasis of TFRK could assist in creating awareness among the younger generation in local communities of the importance of preserving local practices and cultures which are quickly eroding. At the national front, it serves to preserve and project the uniqueness of the social make-up of the pluralistic societies.

International and National Efforts

At the international level, TFRK was not an important issue prior to Earth Summit held in Rio in 1992. The International Labor Organization (ILO) Convention 107 of 1957 (ratified by 27 countries) concerned the Protection and Integration of Indigenous and other Tribal and Semi-Tribal Population in Independent Countries within national development. It was later revised in 1989 by ILO Convention 169 (Concerning Indigenous and Tribal Peoples in Independent Countries), ratified by seven countries, that affirmed the need of government to take action to protect the rights of the indigenous peoples and respect their cultures and values related to lands.

It was during the 1992 Earth Summit that the symbiotic relationship of biodiversity, sustainable development and Indigenous communities was emphasized. Agenda 21 called for TFRK recognition and protection. It was Article 8(j) of the Convention on Biological Diversity (CBD) that gave it a legal stature. This Article of CBD stipulates that "*Each Contracting Party shall, as far as possible and as appropriate: (j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of suck knowledge, innovations and practices and encourage the equitable sharing of benefits arising from the utilization of such knowledge, innovations and practices".* The International Year for the World's Indigenous People (1993) promoted further international technical and financial cooperation for the development of TFRK.

At the national level, efforts were also made to protect and preserve the TFRK of the local forest-dependent communities. For example, in Malaysia, under the Aboriginal Peoples Act 1954 (revised 1974), aboriginal reserves and aboriginal areas established and rights of occupancy on unalienated land for the aborigines.

The above international and national instruments do not provide adequate protection to TFRK. Since the 1990s, erosion of traditional knowledge can be attributed three inter-related factors, namely (a) modernization resulting in reduced forest dependence, (b) lack of interest of the younger generations to apply TFRK in their ways of life and also the failure of the older generations in transmitting such knowledge, and (c) absence of systematic recording and documenting of traditional knowledge.

In the 1990s, the market-driven forest certification schemes emerged as an important supplementary tool used in enhancing the value of TFRK.

How does forest certification enhance TFRK value?

While forest managers in many parts of the world ignored and neglected traditional knowledge practices in the past, the trend is now changing. Since the implementation of forest certification schemes more than a decade ago, the social pillar of forest certification is now gaining more attention. More and more consumers in the developed countries are demanding that the social issues in forest certification need to be properly addressed. The winds of change are affecting traditional forest management. Among the major certification schemes are the Forest Stewardship Council (FSC), Pan-European Forest Certification (PEFC) in Europe, Malaysian Timber Certification Council (MTCC) in Malaysia and Lembaga Ekolabel in Indonesia. In general, these certification schemes aim to promote environmentally sound, socially beneficial and economically viable good forest management of the world's forests.

Under forest certification, the forest managers need to consult the local communities prior to timber harvesting. In drawing up the forest management plan, the traditional use rights of the local communities are to be respected and their sites of economic, cultural and religious significance to be protected. These social and cultural sites are considered high conservation value forests (HCVF). During harvesting activities, the social impacts are to be monitored. Mechanisms have to be developed in resolving conflicts and in compensating the local communities for the loss of their resources. Forestry development must also benefit the local communities through priority of employment, training and the use/development of non-timber forest products. After timber harvesting activities, there is a need to make efforts to conduct social assessments as part of the forest management plan (FMP) or when such plans are periodically revised.

There is a need to respect the native customary rights of local communities even if they do not have legal claim to the forest concession to be certified. If the forest management unit (FMU) manager were willing to incorporate local needs in forest harvesting planning and initiate capacity building among the locals, forest certification would face less difficulty.

Certification bodies such as MTCC and FSC expect issues related to the local communities, workers and indigenous peoples be addressed. In short, forest harvesting should bring benefits to them while minimising adverse impacts on their traditional practices related to the forests.

Conclusion

With the adoption of the United Nations Declaration on the Rights of Indigenous Peoples on 13 September 2007, more concerted efforts are expected to be made to protect and preserve traditional forest-related knowledge. It is expected that the market-driven forest certification schemes would continue to be effective tools to enhance the TFRK value. The shift in paradigm by giving more attention to local social issues has tremendous long-term impacts the livelihood of local communities. It means that the local forest dependent communities can continue to use their traditional land and resources to improve their livelihood and to alleviate poverty. Their knowledge on the use of the forest resources could contribute to the development of various products for modern use. In return, more benefits are expected to be gained by the local forest dependent communities through benefit-sharing mechanisms.

Responding to international development (including demand for certified timber) and national development visions, Malaysia, for instance, has initiated a centralized database on medicinal and aromatic plants of the indigenous peoples. A benefit-sharing mechanism on the use of forest traditional knowledge related to biodiversity conservation and sustainable utilization will be proposed under the Ninth Malaysia Plan (2006-2010). The project is expected to create a partnership between researchers and the indigenous peoples. The issue of local benefit-sharing and intellectual property rights is expected to be addressed. Forest certification could thus play a key role in achieving sustainable forest management, poverty alleviation and preservation of traditional practices among the forest-dependent communities in the long run.

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THE EFFECTS OF TRADITIONAL CULTURE ON THE MODES OF FOREST MANAGEMENT IN ETHNIC COMMUNITIES: A CASE STUDY OF A MIAO VILLAGE

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Introduction

During the 1950s and 1960s, following a series of reforms, collective ownership was established in China, with the means of primary production (land, and farm animals, etc) being transferred from private ownership to collective ownership. At the end of the 1970s, when the land household contract responsibility system was introduced nationwide, corresponding reforms were also implemented in relation to forestry. The forest household responsibility system was introduced. However, these reforms were much more complicated than the cultivated land household responsibility system and created more conflicts, largely due to low levels of public awareness, different natural resources and regional characteristics.

The Southeast Guizhou Miao and Dong Autonomous Prefecture is one of the most important forest areas in Guizhou Province and China. The forests in this Prefecture are mainly located in local ethnic communities, with collective forests accounting for more than 90% of the forest areas. What kind of management modes [methods?] have the ethnic communities chosen after so many reforms? What are the factors they took into account when they made these choices? What are the effects of the traditional culture on the modes of forest management? How are the private forests and contracted forests managed? Are the contentious “collective forests” really necessary? And are the traditional management modes compatible with the relevant laws? Taking Fanpai, a Miao village in Taijiang County of this Prefecture as an example, this paper makes an inquiry into these issues.

Methodology

Literature review, workshops, semi-structured interviews, field studies and participatory rural appraisals (PRA) were used for data collection. Five types of forests in Fanpai Village were included in the study:

a) Forests Managed by the Village Collective. These include the following forests: a Gusheshan or Sacrificial Forest, where the ancestral graves of the local Miao people are located and where the most important local festival, the Guzhang Festival, takes place every 13 years; a Baozhailin, or Guardian Forest of the Village; two village-run forest farms, being the Wujiang and Yangji forest farms, which are relatively far from the Fanpai Village and difficult to manage; and other collective forests not contracted by the households.

b) Co-managed Forests. This refers to the Sonxi Forest Farm, which is owned by Fanpai Village, but co-managed by the Fanpai, Fanzhao and Wujiaonan villages.

c) Forest Managed by Natural Villages. This refers to the Songba Forest Farm, which is owned by Fanpai Village but managed by five of its natural villages.

d) “Responsibility Forests” which are managed by local households but used by households and the village collective. These forests are very remote, are located on high cliffs and are difficult to manage. They were contracted to local households in 1980 but were not contracted again in 1998 when the second round of the contract responsibility system was introduced.

e) “Family Forests” which are managed by local households. These forests were acquired by local households when the contract responsibility system was introduced in 1980 (for this reason they can also called “contracted forests”). The “Family Forests” are located near the Fanpai village and are easy to manage, with an area of 7,000 mu (1mu=1/15 hectare). In 1998, the village households signed a contract to extend 70 years of their use rights over these forests.

Findings

Firstly, the Gusheshan (or Sacrificial Forest) and Baozhailin (or Guardian Forest of the Village) have existed as collective forests at all times, and under all policy frameworks. Owned by the village collective, these forests have been managed in a traditional way, with even the names of the forests remaining unchanged. This is a common phenomenon in the ethnic communities in Guizhou Province.

Secondly, in terms of management rights, the distribution of the existing forests is similar to that in the past, with forests in close proximity to the village being managed by households, and remote forests being under collective management. Before the Liberation, about 70%-80% of the forests surrounding the village were private forests on private land, and the remaining forests were usually remote and under public ownership. Today, the forests near the village, which account for a large percentage of the total, have been contracted to local households. The contracting households have permanent use rights over the forests. These rights allow them to plant trees and bamboo on the contracted forest land, and to use, sell and deal with the trees and bamboo. In this sense, the contracted Family Forests are similar to the private forests of the past, except for the fact that the forest land remains in collective ownership. The remote forests are still under collective ownership and management due to their remoteness, high costs of management and the high risk of these forests being the subject of disputes.

Thirdly, today's "collective forests", which are managed by the village collective, have similar functions to traditional "collective forests". Before the Liberation, the collective forests included "Brothers' Forests", Gusheshan, Baozhailin and other types of collective forests. "Brothers' Forests" belonged to the brothers of extended families and were used as a place to worship for their ancestors. Gusheshan and Baozhailin are traditional collective forests owned by the village community as a whole, with the former functioning to enhance social cohesion within the village by providing space for the burial of common ancestors and for important local festivals, and the latter providing space in which ordinary sacrificial activities are held. These forests are sacred and inviolable, with community members forbidden from removing any of the forest materials, even the tree leaves. The Miao people worship their ancestors and gods, and their traditional forest culture and management methods have been embodied in their community philosophy, modes of production and daily life, with this playing an important role in the ongoing development of the community.

Compared with the collective forests of the past, the collective forests today have to some extent changed in terms of composition of tree species, and ownership relations. The past collective forests were divided according to the blood ties of the community members and the forest function, whereas today the collective forests are divided according to administrative units. The traditional tenure regime could not separate use right from ownership of forest land. Today's tenure regime separates use right from the ownership of lands. Despite this, the function of the collective forests which serve as places for the conduct of sacrificial activities (Gusheshan and Baozhailin Forests) and those forests which function as sources of public welfare, have not changed.

Fourthly, traditional village regulations and agreements play an important role in forest management. In Fanpai, different forests are managed according to different rules. The Gusheshan and Baozhailin Forests are managed mainly according to village regulations and agreements. Family Forests are managed in accordance with village regulations and agreements as well as the relevant laws and State policies. The Forest Farms are primarily managed according to laws and State policies. Forest disputes among villagers are generally dealt with according to village regulations and agreements. Forest disputes between villages are firstly dealt with on the basis of township regulations and if unresolved, are then mediated by the upper-levels of the relevant State departments. If this mediation is unsuccessful, the parties concerned will resort to traditional customs. This involves the disputants taking an oath before their gods by drinking rooster blood wine. The gods are regarded as the final judge of the dispute, with the dishonest party being cursed.

Discussion and Conclusions

Firstly, significant attention should be paid to the effects of the community's traditional culture and management modes on forest management, so as to bring into play the self-managing functions of the community. For forests under collective ownership, Fanpai Village has chosen a variety of forest management models with different functions, with management by households being the predominant

form of management and co-management by households and the collective being the secondary form. Although the choices of Fanpai have been significantly influenced by the relevant State policies, their decisions have also reflected the traditional culture and community modes of management. Therefore, it is very important to pay significant attention to the effects of traditional culture and management, so as to make use of their low cost self-managing functions and thus improve the efficiency of forest management within ethnic communities.

Secondly, the existence of the troublesome "collective forests" (except for Gusheshan and Baozhailin) which are not included in the contract system and are still under public ownership, which could traced back a half century ago regarding to roots causes and nowadays it exists widely. Historically these "collective forests" were never owned by any specific family or families. This has caused many disputes over the "collective forests". A large percentage of forest disputes in Qiandongnan Prefecture today are related to "patrimonial forests", a kind of "collective forest". Disputes relating to "patrimonial forests" occur from time to time in this prefecture. As the "patrimonial forests" are sacrificial areas, the villagers involved in these disputes are often emotional, and it is not infrequent for fighting to occur, which sometimes leads to casualties. At an individual level, most villagers are not interested in forests which are a source of conflict. However, these forests are necessary because many villages are undeveloped and have few non-agricultural industries or other resources. Therefore, there is substantial reliance on "collective forests" as these are the only source of economic revenue for the village collective on which public welfare is based. Zheng (2003) found the same phenomena in Fujian and Hunan provinces.

Thirdly, the self-managing functions of the village regulations and agreements in collective forest management should be addressed. "Collective forests" are usually remote and susceptible to illegal logging. In the case of illegal logging, the offenders are usually dealt with according to the relevant laws. These people receive less punishment compared with those offenders which are dealt with under village regulations and agreements. It follows that the property rights of the forest owners cannot be protected and preserved. As a result, villagers (forest owners) are discouraged from safeguarding forest timber and but also illegal logging is becoming a more serious issue, leading to more problems and conflicts for forest management.

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TRADITIONAL FOREST-RELATED KNOWLEDGE AND ITS IMPLICATIONS FOR CHINA'S FORESTRY DEVELOPMENT – DEVELOPMENT ANTHROPOLOGICAL PERSPECTIVES

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Understanding the Role of Traditional Forest-related Knowledge in Development

In the past two decades, traditional forest-related knowledge (TFRK) has been a central issue which has received increasing attention from many disciplines, including anthropologists, development experts, foresters and local communities. TFRK can be defined as types of knowledge for production, livelihoods, customs, religion and culture related to forests in the context of the life of community people. This is materialized in the utilization and cultivation of plants, biodiversity conservation, integrated farming systems, forest management practices and community regulations. Anthropologists prefer include traditional knowledge within the scope of culture. Many cases illustrated that core cultural elements are integrated with daily forest management practices and the lifestyle of traditional community people. Thus TFRK has been viewed as knowledge with the characteristics of practical, collective, and location-specific (Nygren 1999), as monolithic and culturally bounded systems (Van Der Ploeg 1993). It is fundamental that culture should never be evaluated in terms of good or bad, modern and outdated. Phrases such as 'centralized or privilege culture', or that 'a culture dominated over another culture', have been rejected.

The burgeoning concern for indigenous knowledge is based on the belief that many failures of development and underdevelopment are due to the prominence of modern, scientific knowledge over local, traditional knowledge. During the 20th century, the world economy has grown 16.5 times in Gross National Production. However, forest-related environmental and social problems, including loss of biodiversity, climate change and desertification, the degradation of natural ecosystem and the enlarged global gap between rich and poor, are all challenging the wisdom of people. As a result, the social conflicts have become more obvious. Competition for resources, cultural conflicts and monopoly over technologies have become principal inducements for disputes between nations and ethnic groups. The colorful traditional lifestyles, knowledge and cultures are fading. However, the disappearance of traditional knowledge and culture is a fundamental reason for these problems. The development orientation of human beings is confused. Each new development practice, theory and methodology has supported by a philosophical norm, and thus questioned by other philosophical frameworks. In reality, scientific knowledge has dominated the course of development with its modern values of culture, standards, and organizational structure, which have penetrated every cell of human life. The protection and utilization of traditional knowledge still has relative weak appeal in this regard.

More and more evidence has shown that TFRK is essential to maintain sustainability and complexity of natural ecosystems. Its role in sustainable forest management, rural development and the maintenance of local culture are irreplaceable. More people and organizations have realized that harmony between development and the environment in local contexts involves research regarding the philosophic and cultural background, and advocate the protection of diversified traditional knowledge. In practice, research institutes and researchers were required to learn from farmers to realize the equity of scientific technology and traditional knowledge. However, we are now facing another dilemma in which the poor farmers normally think that the shortage of advanced technology and capital is the cause of their poverty. They would like to request the assistance of technology and capital and neglect the role of their traditional knowledge.

TFRK is one of the main pools for scientific achievement and technological innovation. And it has great economic value too, particularly in relation to its potential for the pharmaceutical and animal

and plant breeding industries. Much more than that, emphasis is placed on its environmental value and potential for contribution to sustainable management of natural resources from the angle of "global environment". The equity between North and South requires recognition of TFRK's commercial value and role in poverty alleviation from the angle of development practices. The importance of TFRK is becoming more obvious in strategies for forestry development at the global, national and traditional community level.

An Embarrassing Situation for TFRK Research – an Agroforestry Case

Given its long history of farming and great diversity in natural and social conditions, China is rich in TFRK. In China, the prevailing viewpoint is that the lag of technology transfer is the main reason of lack of development. 'Advanced technology' and 'modern science', which were embodied in "top-down" institutional regimes, have dominated contemporary forestry development. TFRK has been marginalized in the arena of forestry norms, academia, research and on-the-ground forest development practices (Liu 2006). In the past 3 decades, universities, and research institutions in China have gathered and documented much TFRK together with western sciences and methodologies. We have tried to overcome the localization of traditional knowledge and disseminate it in a coherent and systematic way.

My master's research topic when I was in Nanjing Forestry University involved pond cypress (*Taxodium ascendens* Brongn) intercropping with crops planted by the farmers in the wetlands of Jiangsu Province in Eastern China, based on their flood management practices. My research was aimed at providing a scientific explanation of its structure and function through deconstructing this ecosystem, nutrient cycling, energy flow, efficiency of soil nutrients, cash and net income flow, etc. However, I did not touch on the issues of flood management, which are very location specific and build on the local peoples' life experiences. After graduation, I joined a paulownia and agroforesty research group on in Chinese Academy of Forestry. More than ten years were dedicated to the study of the integrative function of paulownia crop intercropping and optimal production models. Our research covered many aspects including the biological distribution, changes of microclimate and its impact on crops, changes in soil microorganisms and water fertilization, quality and crops yields, management models for paulownia and their economic returns. We concluded that the optimal model for paulownia intercropping was with wheat and cotton and we identified the relevant management techniques.

Our results were rewarded with a prize for scientific achievements from the ministerial-level authority. Unfortunately, our scientific results were not recognized by most of the farmers in the Huanghuaihai plain, including those farmers living near our experiment sites. Some farmers might have followed our model, some might not have. Some farmers might have followed our model in a particular production cycle, and rejected it in another production cycle. In the year of 1992, around the regions where we established extension sites for paulownia agroforestry, many paulownia trees had been cut down by the farmers. In the view of the 'scientists' like me, we considered the farmers to be 'stupid' or 'shortsighted'. Reviewing documentation on agroforestry research in 1990s in China, many similar studies on agroforestry were conducted in mountainous areas, on plains and in wetlands. Although we recognize that the farmers are wise from long-term farming practices, we have consistently tried to deconstruct this wisdom into systematic knowledge for duplication elsewhere. Although we were devoted to the work of systemization, we found that we encountered many contradictions, particularly when questioning what knowledge can be explained and extended as systematic knowledge, what knowledge can be divorced from local people's local lives and what knowledge cannot. TFRK is independent, localized and life-oriented which reflects the production methods, living, culture and emotion of local people.

The management of land by a farmer is an activity in particular time and under particular conditions. It is like an actor who needs to perform differently according to different situations. When a farmer makes the decision on paulownia intercropping with crops, his or her objective is different to that of other people who are farming at different locations and times. This is a reflection on the capacity and initiatives of the decision maker. Instead of analyzing and summarizing the traditional knowledge into systematic knowledge, it is more significant to understand the traditional knowledge from its description, case analysis, related natural conditions, cultural background and local power structure.

Strategic Recommendations for China's Forestry Development

From the perspective of development anthropology, the protection of traditional forest-related knowledge is a wise option for the sustainable development in terms of protecting the achievements of human civilization and the diversity of lifestyles. However, disputes clearly exist in the contemporary world. In the era of globalization, new knowledge, information and foreign cultures have reached every corner of the world. Traditional communities have become an important component of the world economy that cannot be simply isolated. Although the promotion of opening traditional communities to communication with the outside world can improve the livelihoods of local people, it increases these communities' dependence on the outside world and threatens the fragility of natural resources. Some cases have demonstrated the benefits of enlarging the sale of non-timber forestry products to local people (Liu 2007). But in other cases, the marketing activities of outside interests have often depleted and even destroyed local cultures and these natural resources. A simple answer does not exist. The following are some key recommendations for China's forestry development.

Firstly, new initiatives on practices, such as community empowerment, capacity building, legislation and financial support need to be given high priority by Chinese academics and the Chinese government.

Secondly, only when an appropriate normative framework, evaluative standards, conceptual theory and methodology for protection and utilization of traditional knowledge has been established, will traditional knowledge be in a position to share an equal role with the scientific knowledge in development. Suitable regulations should be stipulated to protect local people who have created and inherited TFRK.

Thirdly, integration of scientific and traditional forestry-related knowledge should be promoted. 'Transformation' and 'actor' are the essential terminologies in development anthropology. We believe that the cultures are dynamic and weak cultures will always be invaded by stronger cultures. 'Localization' is always accompanied by 'modernization'. The history of scientific forestry in China is only about a hundred years old. We should not totally abandon the colorful TFRK, which has been practiced for many years. 'Grafting' and integrating traditional knowledge with scientific knowledge is the optimal option for Chinese forestry development. Just as Sociologist Master Fei Xiaotong said: 'mei ren zi mei, mei mei yu gong', which can be translated as "By appreciating and taking up the beauty of others, we are all beautiful". In this regard, China is the country that can be a leader in terms of enhancing the role of TFRK in development

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TRADITIONAL ECOLOGICAL KNOWLEDGE AND FOREST MANAGEMENT IN THE JINUO SOCIETY

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Traditional ecological knowledge was investigated in the Jinuo society in southern Yunnan, through the approaches of ethnoecology, anthropology and participatory rural appraisal. Their traditional forest management system, in particular, was paid special attention. Forests in the Jinuo community were traditionally divided into watershed forest, auspicious forest, sacred forest, shellac forest, village/clan boundary forest, fire protection forest, burial forest and swidden fallow forest. Every type of forest was managed through traditional regulations. The village or clan headman and his assistant were the representatives to implement the traditional management system. Because it was popular with local villagers and there was strict punishment of offenders, the management system was effective. Local people have benefited from traditional tea-gardens in the last a few years, which strengthened local people's understanding of traditional ecological knowledge. In recent years, however, the constantly changing forest management policies have not helped either to preserve biodiversity, or to develop forestry. Instead, forest ecosystems have been destroyed. After studying the forests in the Jinuo community, the authors strongly recommend that the indigenous forest management system be strengthened. Modern forestry policy itself cannot implement sustainable, productive forestry and conserve biodiversity unless it is combined with the indigenous management system of the community.

THE ROLE OF TRADITIONAL BELIEFS OF THE 'WHITE HORSE' TIBETAN PEOPLE IN BIODIVERSITY CONSERVATION AT BAI-SHUI-JIANG NATURE RESERVES

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Introduction

The Bai-Shui-Jiang Nature Reserve is located in the southern part of Gansu province in China. It has rich biodiversity, including 102 giant pandas, Golden monkeys and Takins and so on.

There is a special ethnic group named White Horse, local residents of Bai-Shui-Jiang Nature Reserve. They worship white horse and many tribes regard white horse as their totem. They are much different from Tibetan people, because they do not embrace Tibetan Buddhism and have their special language, unique ethnic costumes, special weddings and funerals ceremonies and traditional life customs.

The white horse people have many common national psychology, and ancient beliefs. These traditional beliefs and knowledge are represented by their worship toward nature. According to He and Wu (2004), traditional knowledge plays an active role in the nature resource and biodiversity protection. Many counties employ not only the modern biology technology such as establishing Nature reserves and parks but also many traditional means of indigene people such as nature resource and environmental protection based on traditional beliefs (Xu 2005).

This paper was based on field investigation and literature review to analyze the traditional believes of the White Horse people at Bai-Shui-Jiang Nature Reserve. The paper described the content of the traditional believes of the White Horse ethnic group, analyzed the relationship between traditional knowledge and biodiversity protection, and put forward some suggestions to use and protect the traditional believes and knowledge of the White Horse ethnic group.

Methodology

Study areas

We chose the communities which is the nearest to the core zone of the nature reserve as study area, according to the administrative maps of the Bai-Shui-Jiang Nature Reserve. Within the study area, we focus only on the villages that have high population density and concentrated white horse people. Based on this analysis, we have chosen three villages Yanggashan, Zaikeqiao, Diebaozai as our study area. Altitude in this area of the three villages is above 1500 m. They are the nearest community to the core zone of the Nature reserve and people in these communities may have direct influence on the nature resource protection. There are 130 households in the three villages, among which 80% is white horse people, most concentrated white horse community in the Nature reserve.

Field surveys and data collection

The relationship between White Horse people and the Nature Reserve was evaluated through repeated filed surveys and household interviews during 2005-2006. These enable us to know: (1) Geography and nature resources in the Nature Reserve. (2) Basic information of these villages and impact of the existence of the nature reserve to the community in the livelihoods and habits. (3) Main traditional habits and believes of the white horse people. (4)Where and how the White Horse people exercise their habits and beliefs on the nature resource protection.(5) Attitudes of the local people on the administration of the Nature Reserve (6) Conflicts between habits of the white horse people and nature resource management.

Qualitative interpretation

Data analysis coupling with modes of situational analysis indicated the link between the data and the conclusion. Data treatment measures, such as analogy, induction, reasoning, analysis and summarization were used to identify the existing problems.

Results

The white horse people around Bai-Shui-Jiang nature reserves have old and special traditional believes. These traditional believes are represented by the worship toward nature such as the God ,land ,sun ,trees ,mountains ,water, animals and so on.

Worship toward trees and mountains plays an important role in the biological diversity protection and management of local ecosystems of biological species. For example, among the three villages, every village has one piece of pine trees or shrubbery that can not be cut forever in the back hill of their village. Every villager regards this piece of trees as safeguard for their living and production, symbol of harmonious and prosperous village. They protect and worship this piece of tree. Usually in the winter or in the time of hardness e. g. sick children, bad fortunate and so on, they will go to the hills and sacrifice for the trees. Under this concept, this piece of trees grows very well, providing habitat for birds and many other small animals.

The White Horse people also worship animals in the Saint Mountains. They think that animals in the Saint Mountains are poultries and livestock of deity. Monkeys, giant panda, black bears, tigers, snakes, horses, eagles and dears are regarded as their ancestors and protectors. Giant panda is the main protected animal in the Bai-Shui-Jiang Nature Reserve. The White Horse people believe that giant panda is a nature being that has spirit. If anyone tries to catch or slay the giant panda, he will be punished strictly by God. And in the everyday life and production, they form the habit of protecting giant panda. In 1976, many bamboos began to flour, and the giant panda were threatened by the lacking of food. In the rescue work for giant panda, the White Horse people did a good job. Between 1976 and 1977, people in the Nature Reserve saved 11 giant panda, among which 8 were saved by the White Horse people in the three villages.

The hunting habitude of ancient White Horse people also embodies simple ecological ethic that is respecting living beings. The hunting habit of White Horse people has special characteristics: they think hunting is some kind of activity that is dangerous and not supported by God, so they would offer sacrifice to the God (Hanba) before going to hunt and also sacrifice to God to beg mercy when slaughtering animals. And there was an unwritten law that hunter cannot recruit more than two prentices. This was because hunters usually use many acrimonious means to catch and slaughter animals so more prentices means more animal would die and their sin would become even serious.

Nowadays hunting is strictly forbidden. In 2002, government enacted a law to withdraw private guns, guns of White Horse people were taken away by the Nature Reserve. At first, the White Horse people cannot accept this change, but they quickly reduce and cancel the activity of hunting, instead they begin to cultivate pigs, horses and other animals to get food. So, this kind of behavior also represents their ethic of nature protection.

Discussion

In the context of the practices of production and daily life, the White Horse people around the Bai-Shui-Jiang Nature Reserve in Gansu province had developed rich tradition knowledge, technologies, and grass root institutions, which are in harmony with the nature and eco-logical system and has greatly contributed to the protection of bio-diversity (including giant panda) and maintenance of livelihood in the community.

However, the forest eco-system management protection nowadays usually stress on the application of modern knowledge, technologies and institution, establishing new nature reserve administration and introducing new crops and technologies to promote economic and social development in the community. Little emphasis has been given to the traditional knowledge, technologies and grass root institution when too much stress is being placed on the modern knowledge and technologies. The function of traditional belief, grass root institution of the White Horse ethnic group to the biodiversity protection and community development are often ignored, which often leads to the contradiction between the nature reserve and community.

What’s more, because the White Horse people have no written word, they pass their traditional

knowledge one generation by one generation from the old people. So the traditional knowledge is faced with the problem of vanishing. More serious challenge is that 85% youngsters of the White Horse people go out of their villages to work and live, so their nationality decrease and many youngsters cannot even speak their own language because there is no language atmosphere out of their own villages.

Given the danger of disappearing of the White Horse ethnic group traditional culture, it is necessary to rescue local culture as soon as possible. Firstly, it is necessary to launch a program to systematically study the language of White Horse. Secondly, it is required to research the traditional culture, including traditional beliefs, material and cultural, technical and cultural, ethnic costumes and culture. Finally, it is a must to study their ecological concept and make full use of results to facilitate the biodiversity conservation at the Bai-Shui-Jiang Nature Reserve.

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LOCAL AGRICULTURAL BIODIVERSITY KNOWLEDGE AND ADAPTIVE CAPACITY TO HOUSEHOLD CONSUMPTION AND MARKET PREFERENCES IN SOUTHERN CAMEROON

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Introduction

Adaptive co-management is emerging as a new challenge to deal with the management of complex system applied to natural resources (Ruittenbeck & Cartier 2001, Olsson *et al*. 2004, Woodley 2004). Adaptive capacity is defined as the general ability of institutions, systems, and individuals to adjust to potential damage, to take advantage of opportunities, or to cope with the consequences (Olsson *et al.* 2004, Millennium Ecosystem Assessment 2005). In the humid tropics, the agro-ecosystems resulting from the interactions between society, agriculture and natural systems, are complex and diversified to respond to human utilizations (Plummer & Armitage 2006.). These ecosystems include, by definition, people and their institutions, as well as the agricultural biodiversity that they use and influence through their diverse range of social goals and definitions of well being (Diez *et al*. 2003, Prabhu 2003, Plummer & Armitage 2006). With this in mind, we asked ourselves: How does local agricultural biodiversity knowledge respond and adapt to household consumption needs, livelihoods profile and market preferences? This paper is located at the intersection of the understanding of local natural management practices within this evolving context on knowledge, the concepts on which they are based (both content and context), in one side, the emergence issue of socio-ecological resilience as a capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks. This is particularly relevant in the cases where the intervention or improvement of local practices in changing ecological and economic scenarios is aimed for socio-ecological sustainability. It becomes critical to analyze how local agricultural biodiversity knowledge responds and adapts to household consumption needs and market preferences. In this paper, we examine the capacity of local ecological knowledge distribution to respond and adapt both to market preferences, household consumption and sustainable livelihoods. The hypothesis to be tested is that local agricultural biodiversity knowledge is a tool that affects market preferences, household consumption needs and livelihoods approaches.

Methodology

The study site is the humid forest zone of Southern Cameroon, embedded in the Congo basin. The general research approach is a multidisciplinary landscape assessment [MLA]. The MLA is built on a set of methods that involve an explicitly multidisciplinary and collaborative process to define and collect the most useful or decisive information with regard to environmental impacts and local people's perspectives. The pilot study was conducted in 6 villages selected from the humid forest benchmark of Southern Cameroon based on criteria of resource intensification use and density of population gradient levels [low, medium and high]. More specifically: (i) 30 households have been selected randomly including 5 per village; (ii) Multi-resource inventories have covered from 5 to 20% of the surface of each agroforestry land uses. 5 types of agro-forestry land-uses belonging to the forest-cropping-fallow cycles were targeted: 15 year old young secondary forests, 5 year old pre-forestry fallows, forest farms, mix-cropping farms and cocoa farms. These inventories covered more than 183 plots; (iii) Household surveys on agricultural biodiversity knowledge have been conducted after the multi-resources inventories to the same 30 households. SPSS/SAS and R were used for descriptive

and explicative statistics including comparison of means, correlation-regression analysis, and multi-criteria and multivariate analysis, and principal component analysis.

Results and Discussion

The socio-economics characteristics of research sites are made as well as the profile of respondents. The socio-economic environment of respondents in terms of capital natural, physical, financial and social capitals is characterized. The mapping of agricultural biodiversity knowledge in term of trees species domesticated and crops cultivated in relation to household consumption needs and market preferences is made. The Chi-square analysis shows that farmer's natural and social capitals are positively correlated to spatial distribution of agricultural biodiversity knowledge. This confirms the central role of social capital in biodiversity conservation and management (Ruittenbeck & Cartier 2001, Prabhu 2003, Pretty & Smith 2004). The results have shown that financial capital is less correlated to agricultural biodiversity knowledge because people with high financial capital domesticate less trees that those with less financial capital. Moreover, the results show that knowledge of market preferences and domestic consumption affected the agricultural biodiversity distribution patterns in terms of number of tree domesticated each year and diversity of crops cultivated to maintain productivity and quality yield. This confirms that every socio-ecological system is embedded in building resilience through adaptive governance processes in order to maintain their essential functions within spatio-temporal scales (Folke *et al.* 2002, Dietz *et al.* 2003, Folke *et al*. 2005, Plummer & Armitage 2006). Finally, the paper suggests taking seriously local agricultural biodiversity knowledge as a key tool that can help to mobilize local community in order to develop livelihood scenarios and options towards adaptive management of natural resource.

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TRADITIONAL INDIGENOUS KNOWLEDGE BASED CONSERVATION AND LIVELIHOOD STRATEGIES FOR SUSTAINABLE FOREST RESOURCES MANAGEMENT IN THE UPLANDS OF BANGLADESH

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Introduction

The Chittagong Hill Tracts in southeast Bangladesh contains most of the upland forested watersheds of the country (Khan 1991) that support shifting cultivation subsistence farming called *jhum*, in 13 indigenous communities living there (Gain 2002). Over recent decades, environmental degradation in the Chittagong Hill Tracts has accelerated due to widespread destruction of natural forest ecosystems. Clear-felling of trees done for establishing monoculture based plantations has deprived communities from their age-old customary rights over the forest resources (Roy 1995) and made the hill soils difficult for traditional farming. Population growth necessitated an intensification of jhum and other agricultural activities in the hilly landscape, which together with deforestation, caused serious soil erosion and deterioration of water quality. Environmental degradation and gradual declines in jhum productivity has jeopardized peoples' livelihood. In response to the crisis, large-scale projects on development of horticulture and other cash crops have been implemented in order to diversify their livelihood opportunities (ADB 2001).

The conditions of the poorest strata of people have remained unchanged, however, as equitable sharing of benefits from such projects could not be ensured (Roy 2002). Moreover, conservation of natural forest ecosystems was neglected in those projects. Traditional jhum farming yet remains the source of life blood for the majority of the hill people. Interestingly, in some places indigenous people still maintain community managed forests, or *mouza-bans*, supported by unique traditional knowledge systems which yet remain unrecognized by government agencies (Khisa et al. 2006). Mouza-bans contain headwaters of streams, natural springs and other aquifers, and are large repositories of biodiversity. Traditional jhum farming combined with activities in and around the mouza-bans or Village Common Forests have the potential to directly contribute to sustainable community livelihood while representing model conservation practices for sustainable natural resources management in the region. However, pressures from the government Forest Department to include un-classed state forests that harbor these community forests as reserved forest areas for raising plantations, as well as pressure from other Government agencies for their conversion into rubber and other horticultural plantations, has led to gradual decline in these forests' size and number. The objectives of the study were to evaluate the existing livelihood strategies of the mouza-ban communities, and to assess the possibility of enhancing their livelihood opportunities through means that could ensure equitable sharing of benefits from some novel projects that would not only be environmentally sound but also culturally acceptable.

Methodology

Besides direct observation of the homesteads and common forest lands of the mouza-ban areas, household surveys using pre-tested questionnaires were conducted. Household heads from about 100 randomly selected households in some of the mouza-ban villages of Rangamati and Banderban districts of the Chittagong Hill Tracts were interviewed. About 40 households from neighboring villages who were not dependent on mouza-bans were also interviewed for comparative purpose.

Results and Discussion

Livelihood strategies

The study has revealed that there is a greater community potential for conserving their resources, for example, by making greater use of bamboos than wood thereby conserving timber species, more judicious use of medicinal and culinary herbs and wildlife etc., and a better maintenance of the

perennial water sources as compared to the neighboring people that do not have mouza-ban. Mouza-ban communities earn their livelihood from a diversified range of sources such as growing rice and a wide variety of local vegetables and horticultural crops, rearing livestock in their homesteads, and by selling both processed and unprocessed forest products.

Conservation of watersheds

Arranged in labyrinthine networks of smaller watersheds, mouza-bans represent excellent models of resources conservation in the deteriorating hilly landscape that ensures perennial water supply essential for all possible livelihood activities in and around the villages. Maintenance of permanent tree cover and undergrowth on mouza-ban forest floor ensures soil and moisture conservation. These conservation techniques could be strategically used for implementing sustainable forest management in the heavily degraded parts of the Chittagong Hill Tractss.

Potential for development of ecotourism and PES schemes

There were mixed reactions among the respondents about the potential of community based eco-tourism in enhancing their livelihood opportunities though most of the educated respondents showed no objection to the idea. More respondents in Rangamati district than those in Banderban district expressed their interest for participating in community based eco-tourism development. In order to protect the traditional forest related indigenous knowledge systems, the mouza-ban communities might be considered for Payments for Environmental Services (PES) schemes by the interested local as well as international bodies. This would not only guarantee a secure means of livelihood for the communities but also help them maintain their indigenous techniques and practices of resource conservation that upon being incorporated in the management plans could positively contribute towards sustainable forest management. Respondents from Banderban district where households represented some of the economically disadvantaged communities such as Mro, Tripura and Bawm showed immense interest for such schemes.

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AN ENABLING POLICY FRAMEWORK FOR HARMONIZING TRADITIONAL FOREST-RELATED KNOWLEDGE WITH SUSTAINABLE FOREST MANAGEMENT STANDARDS

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Introduction

Worldwide, there is a growing awareness of the environmental, economic, social and cultural contributions of forests. One of the greatest challenges facing the forest sector at present is the need to reconcile the needs and interests of the various stakeholders. Significantly, the concept of sustainable forest management has influenced many new initiatives and even prompted reshaping of existing forest policies.

Illustrating this emerging trend, this paper synthesizes key findings from a recent consultative process of formulating a new National Forestry Policy in Mauritius (a country having similar bio-physical conditions as in Asia and the Pacific) for the development of its forestry sector based on the scientific principles for sustainable forest management and practicalities related to traditional knowledge.

Overview of the Forestry Sector in Mauritius

Mauritius, a small island developing state having an area of 1860 sq. km, faces various physical constraints that are similar to other small islands. With a few exceptions, most small island states have very limited forest resources. The forests of Mauritius are small in area but perform vital functions, the most important of them being soil and water conservation. Where water is scarce, all major activities like agriculture, tourism or manufacturing, are seriously affected. The environmental functions of forests far outweigh their direct economic functions. In fact, the forests of the island are now managed more for these functions rather than for the production of timber. Forests also play an important role in carbon sequestration and in the conservation of biodiversity and wildlife. In addition, it is generally recognized that forests in such islands have great ecological, social and cultural significance

The total forest area of 56,742 ha accounts for about 31% of total land area of which 68% are natural forests and 32% are plantations. There are only two types of forest ownership: privately owned forests comprise 61% and State owned forests comprise 39%. There are no communal forests and no communities are living within or are dependent on the forests. Because of the rising value of land, private forest owners are more inclined to convert their forestlands to more profitable land use such as ecotourism and housing development than to improve and manage them for timber production

The forestry sector includes all activities dependent on forests, trees and other woody vegetation, and all forest based industries. The sector has numerous interactions and linkages with other sectors, such as agriculture, water, environment, tourism and communications.

As a sector, forestry is subject to pressures coming from many directions to which it has to respond. Events outside the sector create new possibilities for improvement, but also bring dangers that must be avoided. Extra demands are continually being made due to people wishing to profit from forests in some way or to enjoy recreational experiences in a natural environment. On the one hand, they can be used to provide additional benefits of many kinds for the people, on the other, they need to be adequately protected and developed.

Methodology and Process of Developing Policy Framework

Work on formulating a new Forest Policy under Project titled “Review and Formulation of the National Forest Policy in Mauritius” began in October, 2004, and was completed in April, 2006. It was undertaken by the Forestry Service under the direction of the Ministry of Agro-Industry and Fisheries. International assistance for the formulation of the Policy was provided by the Food and Agriculture

Organization (FAO) of the United Nations under its Technical Cooperation Programme It replaces the previous official Forestry Policy statement enunciated way back in 1963.

Since the process of policy formulation was to serve as a "bridge" between understanding the present status and defining a future vision, it was considered necessary to devise an analytical framework to assess the current policy framework in relation to scientific standards for achieving sustainable forest management (SFM). Thus an analytical frame work having 7 Criteria and 44 Indicators for (SFM) was used for diagnostic analysis and as a check-list to classify existing policies, to facilitate debates and consultations and to build consensus on redefined priorities.

Key Results

Based on the outcome of discussions and consultations, the revised Policy has synthesized a set of guiding principles in order to protect and enhance the country's natural environment, biodiversity and national heritage, while at the same time promoting recreation and tourism. Based on these principles, the overall goal of the National Forestry Policy is to create public awareness of the productive and protective functions of the forests, and to ensure the conservation and sustainable management of forests and forest ecosystems of the country for the benefit of present and future generations.

In addition, the following main forest management issues hindering progress in the forestry sector towards sustainable forest management were identified after detailed discussions with stakeholders. Goals, objectives and strategies have been proposed to address these issues:

1. Conservation and protection of watersheds and other environmentally sensitive areas to ensure sustainable development, management and protection of watersheds and to increase and regulate freshwater resources for all purposes and at all times

2. Increasing tree cover to enhance the environment and the carbon sink capacity of the forests and to prevent further denudation of forest areas and increase the area under native tree cover

3. Degradation of native forests by invasive alien species and to reverse the process of degradation of biodiversity through habitat restoration using *in-situ* and, where necessary, *ex-situ* conservation techniques.

4. Deer ranching: The present practice of deer ranching can be harmful to trees and young seedlings, if appropriate measures are not taken to protect the young trees until they reach a certain height. It is estimated that there are about 70,000 head of deer in the country (60,000 head on private lands and 10,000 on state forestland leased to deer ranchers) occupying 25,000 ha, with an average stocking of 2.6 deer/ha. Therefore it is necessary to adjust the stocking rate of deer in state and private forests to match the carrying capacity of each ecological area.

5. Development of inland recreation and eco-tourism business in order to diversify tourist services and encourage restoration of natural forests and biodiversity through effective participation of all the sectors concerned.

6. Forest destruction by recurrent cyclones, fire, insect pests and diseases and steps to be taken to mitigate the effects of damage caused to forests by biotic and abiotic agents.

7. Conversion to forest of abandoned sugar-cane land in environmentally sensitive areas by replanting with tree species on mountain slopes that are unsuitable for other purposes in order to prevent land degradation and create income generating activities.

8. Land degradation: To improve the management of lands in order to restore soil fertility, improve soil productivity for agricultural production, animal husbandry and forestry and plant suitable native tree species and non-invasive exotics in combination with agricultural crops and high-yielding pasture species.

9. Development of small forest-based businesses for income generation to contribute to poverty alleviation in communities through developing small-scale forest-based businesses.

10. Improvement of the Forestry Service and to establish a highly technical, efficient and effective public forestry administration which is capable of promoting the sustainable management of forest resources to meet societal demands for products, forest resource conservation, recreation and environmental services.

Finally for implementing the National Forestry Policy, a set of following key enabling elements have also been proposed: Sectoral planning, Investment in the sector, Intersect oral coordination, Institutional reform, Forestry legislation, International cooperation, Sector monitoring and evaluation

As a case study, this paper aims to highlight and share experiences related to a practical example of developing an enabling Forest Policy framework for harmonization and fine tuning of traditional knowledge and site specific forest management practices with internationally accepted standards for achieving sustainable forest management.

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KNOWLEDGE AND USE OF LOCAL PLANTS FROM *'SIMPUKNG'* OR FOREST GARDENS AMONG THE DAYAK COMMUNITY IN EAST KALIMANTAN

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Introduction

Natural resources, including forests, are important to the Dayak people in East Kalimantan for their basic existence, and their life-styles are closely inter-connected with surrounding natural resources. Land and forests are not merely used for economic purposes but also used for maintaining and protecting local people and their culture. *'Simpukng'* is a mixed fruit garden (or forest garden) that has a very important value among the Dayak people. Simpukng are mostly protected and consist of both cultivated and wild flora that provide environmental and economic benefits. The existence and importance of local plants, especially with medicinal properties, and Dayak people's knowledge about these are topics of much interest. This study attempted to acquire and document local knowledge and use of local plants from simpukng.

Methodology

The study was conducted in four remote villages (Banggris, Lambing, Dilang Puti, and Suakong) of Kutai Barat in East Kalimantan, Indonesia in 2004. Participatory appraisal tools were used: individual interviews, group discussions, direct observations, seasonal calendars and labor analysis. Interviews were conducted with key informants that included both men and women.

Results and Discussion

Simpukng generally have high plant diversity although in some simpukng a few valuable species may be dominant. The name of different simpukng systems are usually based on the most valuable plant contained within them. *Simpukng tanyut* has honey trees that are highly valued for their wild honey combs; *Simpukng we* or *simpukng rotan* have many rattan plants, *simpukng nunuk* have *Ficus* trees, *simpukng bua* have many fruit trees. Simpukng can develop anywhere – in swidden fields (known as *ladang* or *umaq*) or near settlements (as homegardens) and religious sites. *Simpukng lou* or *lamin* are close to traditional long houses (*Lou'/'Lamin*); s*impukng belai* are close to individual houses; *simpukng lalag* develop on road sides. Simpukng developed from swidden or rice field are called *simpukng umaq* in which valuable fruit and timber trees are retained. *Simpukng lati* are specifically designated reserve areas for construction materials for communities.

Rituals and spiritual beliefs influence simpukng management and utilization. Simpukng managed for traditional rituals and ceremonies are called *simpukng kayu yaq naan entutn* where spirits are believed to dwell. Such spiritual taboos indirectly help preserve *'simpukng'* and other natural resources from exploitation that may lead to degradation.

During the study 143 local valuable plants were identified, mostly belonging to families of *Anacardiaceae*, *Bombaceae*, *Dipterocarpaceae*, *Euphorbiaceae*, *Meliaceae*, *Moraceae*, *Sapindaceae*, *Palmae*, and *Rubiaceae*. Natural regeneration of local trees continues while farmers may also add other valuable fruit trees. Plant species of commercial value are more intensively managed inside *'simpukng'*. These include rattan, some fruit trees such *langsat* (*Lansium domesticum*) and *durian* (*Durio zibethinus).*

Simpukng are diverse fruit orchards. Wild fruits are common - such as mango, mangosteen, rambutan and several species of durian [*layung* (*Durio dulcis*), *kalaakng* (*D. zibethinus*) and yellow durian or *laai* (*D. kutejensis*)]. Mango species include *ncapm wanyi* (*Mangifera caesia*), *kuini* (*M. odorata*), and *ncapm lagatn* (*M. foetida*). Rambutan (*Nephelium lappaceum*), *lempukat* (*N. cuspidatum*), *semayap*

(*N. mutabile*), *ridatn* (*N. mainganyi*), *nakaatn* (*Artocarpus integer*) and *cempedak* (*A. champeden*) also exist.

Young and tender parts of many species (topmost, shoot, sprout, leaves, root, flower and unripe fruits) are considered good for consumption. Immature fruits of *kalaakng* and *nakaatn* are good for making soup, young sprouts of bamboo (*Gigantochloa hasskarliana*) and rattan (*Plectocomiopsos geminiflora* and *Daemonorops*), flower of banana (*Musa* sp.), young fronds of fern (*Cyathea contaminans*), shoots of *Cyperus bancanus* are also important. Male flower stalks of *saraap* (*Arenga pinnata*) are used to make brown sugar; young shoots are used in cooking; and leaves are used as cigarette wrappers. Candle nut (*Aleurites moluccana*) and ginger (*Zingiber officinale*) are used for seasoning. *Bengkuukng* leaves (*M. gigantea*) and *keranyii* (*Fordia sp*) leaves are used in grilling fish and meat. Honey and bee wax are harvested from honey trees [such as *banggeris* (*Kompassia malaccensis*), *puti* (*K. exelsa*), *lomuq* (*Canarium pseudo-decumanum*), *kapur* (*Dryobalanops lanceolata*), *bengkirai* (*Shorea laevis*) and *bilaas* (*Ficus albifila*)] which are believed to be sacred, hence these are prohibited from felling.

Simpukng are also an important source of fuel wood. Local people usually gather dead wood of trees and shrubs and litter remains from cleaning operations in umaq and simpukng. Species like *kelepapa* (*Vitex pinnata*), *emplam* (*M. indica*), *kuini*, *langsat*, *bukuq* (*Dimocarpus longan*), and *deraya* (*Horsfieldia grandis*) are preferred for their high calorific value and less toxic smoke. Floor mat or *lampit* are made from rattans, *we sega* (*Calamus caesius*) and *we seletup* (*C. optimus*); *anjat* or *berangka'*(all-purpose basket) are made from rattan cane *we sega* and *we jahap* (*C. trachycoleus*). Coffins are made of wood from a range of species that grow to a large size and retain the smell of the corpse inside. *Ulin* (ironwood) or *teluyatn* (*Eusideroxylon zwageri*), *kapur* and *sungkai* (*Peronema canescens*) are highly valued for furniture.

Many types of sap, roots, leaves, young shoots, flowers or barks from many plant species are used in traditional medicines. There are customary rules in harvesting medicinal plants. Knowledge about local medicinal plants is not widely known by common Dayak people; only traditional healers in villages hold such knowledge. People are concerned that shared knowledge can lead to misuse. Such knowledge may be shared upon payment of *temaai* that may include money, cloth, rice and knife. The value of temaai varies with the value of medicinal function. Temaai is believed to be essential for retaining medicinal properties of such plants.

Tuba (*Deris elliptica*), *sinak, temelekaar* (*Coptosapelta flavescens*), *lemposu* (*Baccaurea lamponga*) and *merlipas* (*Prunus javanica*) are plants with insect repellent or insecticidal properties. *Siratn* (*Antiaris toxicaria*) poison is used in small dart of blowguns for hunting animals. Special plants are also used in traditional ritual ceremonies such *belian* (ritual for healing person) and *kwangkai* (traditional burial ceremony) many other ceremonies throughout the year.

Rattan is the most important marketed commodity from simpukng. Wild rattan is getting rarer; most rattan comes from planted rattan inside simpukng rotan. Rattan is an economic crop both at household and village levels. Generally women are involved in the rattan trade and also in collection, drying, bundling, sanding, and splitting of canes. Some species of rattan are also used as food, medicine, tools and in Dayak rituals.

It is apparent that local people have knowledge about a range of different plant species in their simpukng or forest gardens. The role of women in seed selection and propagation is crucial for simpukng development and diversity conservation, especially where simpukng are close to settlement areas. Women demonstrated more knowledge about local medicinal and other valuable plants and they clearly performed a wider range tasks compared to men.

During interviews, farmers were somewhat reluctant to give information, particularly about medicinal plants. Some big logging and mining companies have entered the area to clear forests, including simpukng, without local consent. Conflicts, often violent, have occurred in the past. These companies are perceived to be negligent to the role and rights of the Dayak people over the land.

Local communities believe that the potent of the medicinal plants will be reduced if they expose their knowledge to foreigners. Perhaps the issue is more about the intellectual property rights as Dayak communities believe that foreigners 'steal' their knowledge and later use and disseminate without recognition of the Dayak people. Misuse of local knowledge about medicinal plants by multi-national pharmaceutical companies was often cited during the study. There is a need for an appropriate mechanism to protect local knowledge from external exploitation through genuine recognition and regulation; with the possibility economic benefits to the Dayak communities (Sirait et al 2005). The

government, NGOs and other stakeholder companies should support the development and implementation of property right rules and regulations. Reward or compensatory schemes can and should be developed that can address the issue and ensure a fair and reasonable share of benefits arising from local knowledge of the Dayak communities.

Biodiversity degradation is a major issue related in simpukng, often influenced by deforestation, land degradation and other socio-cultural factors. Greater investments should be made in order to capture all of the values created by diversity within evolutionary system (King and Pablo 1999). Maintaining existing systems with in-situ conservation values need to be prioritized to rehabilitation of degraded land by the government. Conservation practices that recognize and value biodiversity and role of indigenous systems and innovations must be promoted. This implies that conservation efforts should not be merely targeted to preserve plants and animals, but also the people, their knowledge, beliefs and traditions that are so closely inter-twined. Only then a truly sustainable and equitable system can emerge. However, currently there is no external appreciation of the local farmers' role in the management and biodiversity conservation. Appropriate reward or payment for environmental services (PES) mechanism is suggested as feasible way to save the simpukng in East Kalimantan and preserve their both environmental and production functions.

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THE ECONOMIC VALUE OF INDIGENOUS ENVIRONMENTAL KNOWLEDGE IN ENSURING SUSTAINABLE LIVELIHOOD NEEDS AND PROTECTING LOCAL ECOLOGICAL SERVICES: A CASE STUDY OF NAGARHOLE NATIONAL PARK, INDIA

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Introduction

The concept of ecosystem services has been considered as an important instrument for understanding the economic and ecological values of ecosystems in sustaining human wellbeing (Costanza 1998). Biodiversity conservation by the indigenous communities with the application of their ancient indigenous environmental knowledge (IEK) has proved to be successful not only in generating local ecological services but also continuous supply of minor forest produce for meeting livelihood needs (WRI 2002). However, scientific forest and wildlife management practitioners have put forth some reservations about the role of IEK in conserving biodiversity vis-à-vis local ecological services (Gadgil 2007). In this paradox, an unfulfilled task is alleviation of poverty and protection of biodiversity in an apt and equitable framework of Sustainable Development (SD) and Millennium Development Goals (MDGs).

Against this backdrop, a study has been carried out in one of the rich biodiversity hotspots of India viz., the Western Ghats in general and the Nagarhole National Park (NNP) in particular, in order to investigate the complex IEK–biodiversity–ecosystem service interface. The study aims to assess the economic and ecological values of IEK held by these indigenous communities. The study also investigates the extent of dependence and utilization of IEK in ensuring sustainable livelihoods and protecting local ecological services. There are 54 tribal settlements in the NNP, comprising interior landless laborers and periphery agriculturists. A total number of 175 households were selected (100 'inside national park' (INP) households from within and 75 'outside national park' (ONP) households from the periphery of the NNP) using stratified random sampling method for the study. Various descriptive and tabular statistics such as frequency distribution, percentages and standard deviation, and chi square tests, were used to analyze the data collected.

Economic and Ecological Values of IEK

The study shows that forests are intricately connected to the livelihood of the indigenous communities of NNP. Forests provide direct values in the form of timber and non-timber forest products and offer a host of indirect values, option values, bequest values and existence values, which accrue to communities in the form of moderating climate, enriching soil fertility and maintaining nutrient balance, regulating water recharge, storm protection which are commonly called as local ecological services. The estimation of these values placed by indigenous communities on forests and economic valuation of forests and their environmental services has been critically hindered by a gap in knowledge and data. Despite indigenous communities' economics of ecological services protection has rendered sustainable livelihoods, appropriate estimation of these benefits is still very weak. However, an assessment and documentation of IEK of key resource users including spatial extent of resources, characteristics of ecological resource base and its carrying capacity is imperative for the success of devolution policy (Ostrom 1990).

IEK held by the indigenous communities in NNP has been extremely effective in terms of identifying and seasonal harvesting of the various NTFPs. It also helps in value-adding processing of NTFPs that ensures reasonable and steady income to the communities. IEK has largely facilitated forest dwellers to eke out their livelihood, protect their nutrition and health and manage their habitats. Households

depend more on the NTPFs in NNP for consumptive and non-consumptive uses. NTFPs generate more than half of the total employment and also contribute to half of the households' total annual income (both within and outside the national park). Forests are in great need for maintaining livelihoods on a sustainable basis in the event of natural calamities and also in the absence of government welfare programmes in the study area. The collection of timber and NTFPs fetches the largest composition of incomes compared to other sources of incomes to both the INP and ONP households. It can also be observed from interpretation of the co-efficient of variation analysis that income generated from the collection of forest products is more stable compared to plantation, agriculture and allied activities with a variability of 18.85 per cent and 47.18 per cent in INP and ONP settlements respectively. This clearly indicates that collection of forest products continues to play a pivotal role in the tribal economy by contributing substantial and also sustainable incomes to forest dwellers (see Table 1).

Table 1. Economic Value Accruing to Indigenous Community from NNP

Economic Sources of Livelihood	Inside National Park (INP)			Outside National Park (ONP)		
	Annual Income (US$)	S.D. [1]	C.V. [2] (%)	Annual Income (US$)	S.D.	C.V. (%)
Collection of Timber and NTFPs	342.14 (54.02)	2710.10	18.85	319.65 (46.45)	6335.17	47.18
Agriculture and allied activities	22.56 (3.56)	1765.18	186.24	80.40 (11.68)	3335.38	98.77
Forest Department work	87.67 (13.84)	3799.14	103.16	56.34 (8.18)	1548.66	65.44
Plantation work	143.46 (22.65)	4475.41	74.27	173.14 (25.16)	4016.27	55.22
Others*	37.51 (5.92)	1745.98	110.81	58.58 (8.51)	2279.46	92.64
Total income from all sources	633.34 (100.00)	1219.22	42.05	688.11 (100.00)	1845.88	52.69

Notes: [1] S.D.= Standard Deviation. [2] C.V.= Coefficient of Variation (%); * Self employment
(Figures in parentheses signify percentages to the total)

Indigenous communities, across the socio-economic status, 146 households out of the total 175 sample households have assigned first rank by perceiving forests as an important source of direct value for meeting their livelihood needs. The second most important value of forests is the indirect value viz., environmental role of forests, to which 83 households out of 110 responded, assigned the second rank. Of the 105 households responded, 77 households have assigned third rank to the issue of forests as being essential to agricultural production and medicinal plants. The fourth important issue, forest as the store of existence, cultural and religious values, has been assigned fourth rank by 63 households out of 93 households responded. It is observed from the value assignment that indigenous communities are clearly aware of the direct and indirect values of forests in achieving sustainable development.

Local ecological conditions, such as biodiversity, soil, rainfall, temperature and humidity, determine continuous evolution of concrete knowledge that is construed as imperative for resource conservation and management. The study shows that about 89 percent of sample households depend on IEK for identifying various timber and NTFPs for their consumptive and economic utilization. Majority of the farmers living in the periphery of NNP (86 per cent) make use of IEK for organic manure application and balancing nutrients of soil. Agricultural productivity of main crop - paddy, is 14 per cent higher per hectare than inorganic manure based farmlands in the neighborhood areas. Medicinal plants and herbs are the basic source of healthcare needs and nutrition requirements for 87 per cent of the sample households and they collect 36 different medicinal plants and herbs for consumptive and commercial use. An Ayurvedic healer of the NNP has been bestowed a state award recently for her effective treatments of many fatal diseases. Indigenous communities have identified nine humid breeze-producing trees that sequester and filter pollution thereby lowers the local temperature.

Streams are the lifelines supplying drinking water and irrigating agricultural fields; and invariably communities have applied their IEK for regulating water recharge and enhancing watershed functions. IEK practitioners have adhered to the principles of carrying capacity of biodiversity thereby consciously restricting harvests of endangered flora and fauna contributing to resource regeneration and conservation. Indigenous communities perceive that IEK practices are appropriate and economically beneficial for 87 per cent of households and ecologically sound for 69 per cent of households towards conserving local ecological services. The study has revealed statistically significant and positive relation between IEK and protection of local ecological services and conserving biodiversity, medicinal plants and wildlife in the NNP.

Does Devolution Policy Recognize IEK in Protected Area Management?

Despite the fact that IEK is increasingly gaining attentions in recent years among academic and policy circles in respect of financial payment and rewards for protecting local ecosystem services such as biodiversity conservation, conversely, little progress has been made in practice. Joint Protected Area Management is a distant dream for indigenous communities although economic and ecological values of their IEK are highly valuable for conservation and management of NNP. Devolution policies such as Extension of Provisions of Panchayati Raj to Scheduled Areas (PESA) Act 1996, the Biological Diversity Act 2002 and the recently passed Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (TFRA) 2006, , have made little progress in achieving inclusive, transparent and participatory biodiversity management. Traditional commands, and controlled polices of Wildlife (Protection) Act 1972, are still continue to influence protected area management which hardly recognizes the importance of IEK in sustainable management of forest biodiversity.

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CONTEMPORARY AND TRADITIONAL CONCEPTS OF SPATIAL UNITS IN KOREAN MOUNTAINOUS LANDSCAPE: UNDERSTANDING OF LANDSCAPE AND MEMORY, GIS DATA, AND COMMUNITY FORESTS (*MAEULSOOP* – THE KOREAN VILLAGE GROVES)

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Introduction

The Korean landscape is a mountain-based one which covers 70% of Korea's land. Most of the mountains in South Korea have been reforested since the middle of the 20th century. Traditional ecological approaches consider the Korean peninsula as a topography-based structure that has been described as follows: 'The Korean land is not flat, it is fluctuating. Therefore, shape of the surrounding mountains is a key factor to understand Korean nature' by (Ch'oe 1994). The major landscape changes during last half of the century due to the Korean War and rapid urbanization have altered the traditional character of Korea's landscape. Building on the traditional topography-based concept toward nature (Shin 2004), it is now necessary to reconsider the traditional ecological approaches to improve the landscape for the future.

Methodology & Hypotheses

Identification of spatial units from landscape and memory

The spatial concepts of Korean landscape patterns was tested in 2002 (Kwon 2002), and nine prototype landscape units have been defined both using GIS tools and people's memory of Korean landscape since 2002. Aerial photographs, DEM and ArcScene with a modified AML were applied to classify the nine landscape types. The key questions for this study were: Could the prototypes be classified by DEM? How big are they? Could they be useful as models which contains various ecological data of Korean landscape?

The study hypotheses considered: (1) whether or not land-use patterns, forest types and habitats of wildlife could be influenced by topography-based structure, because people use the land based on a traditional landscape concept; and (2) whether the nine types of spatial units could represents Korean mountainous landscape. For example, some types are strongly related to farming in history and topographical elements which could cause regional micro-climate differences.

Results & Discussion

Prime spatial units & traditional forests and landscape

The nine types were summarized as follows in previous research (Kwon 2002): Cultivated, Basin, Basin Holy, Corridor Cultivated, Cul-de-sac Holy, Crescent Valley, Enclosed Cultivation, Large Scale-Open Cultivation, Mountainous Settlement and Landmark Landscape. These can be categorized into four groups: Basin type, Valley type, Folding-screen type, and Landmark. The results of classification using GIS tools indicated that the three types of landscape which are the most readily identified are Corridor Cultivated, Cul-de-sac Holy and Enclosed Cultivation Landscape.

According to the test-run results for a national park area (Mt. Jiri), the spatial unit types included Cul-de-sac Holy and Enclosed Cultivation landscape. Locations and shapes of Korean traditional village groves (*Maeulsoops*) have different characters based on the nine types. Based on the spatial units, the major distinguishing features of Maeulsoops are: partition by array, locations of hills for encircling or exposure, locations relative to corridors and waterways, locations of the community they serve, and the conservation of energy.

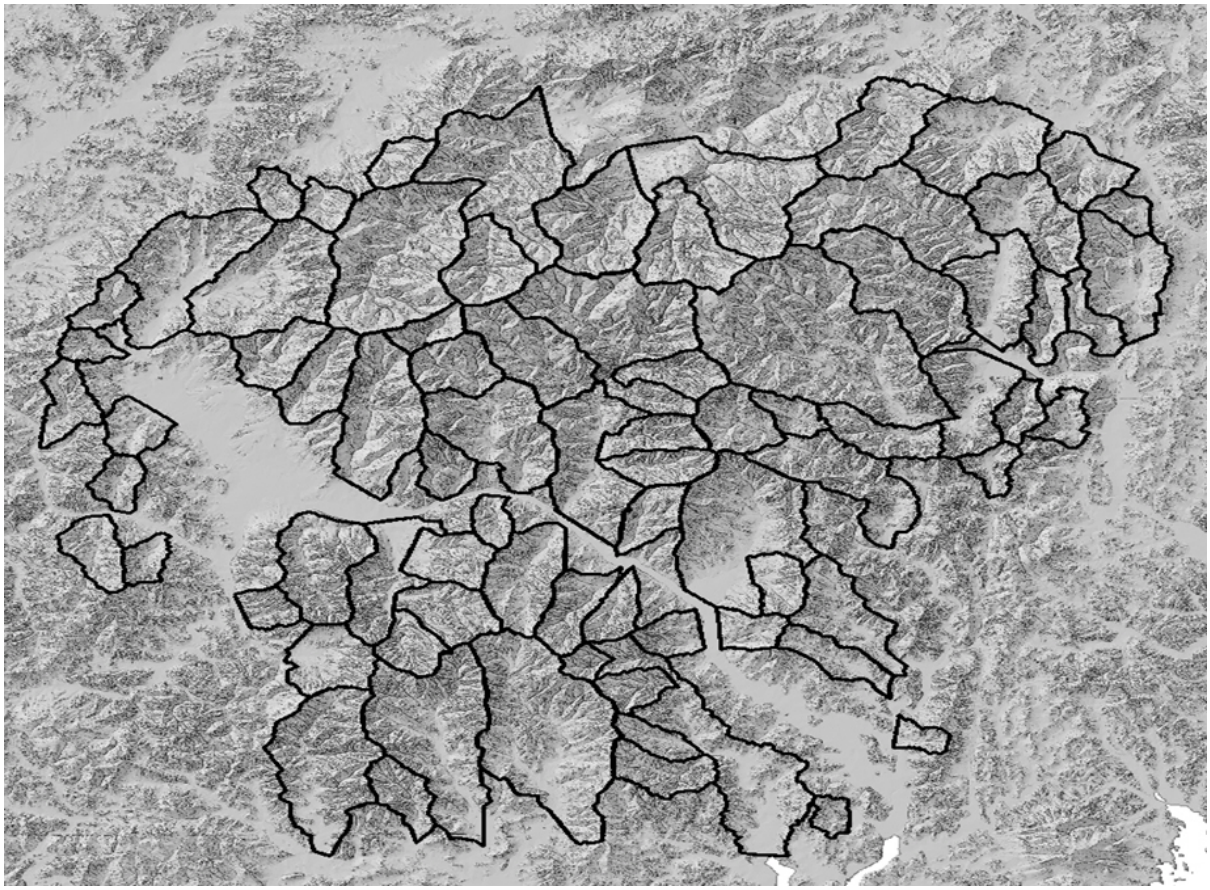

Figure 1. Spatial Units Map for the Mt. Jiri

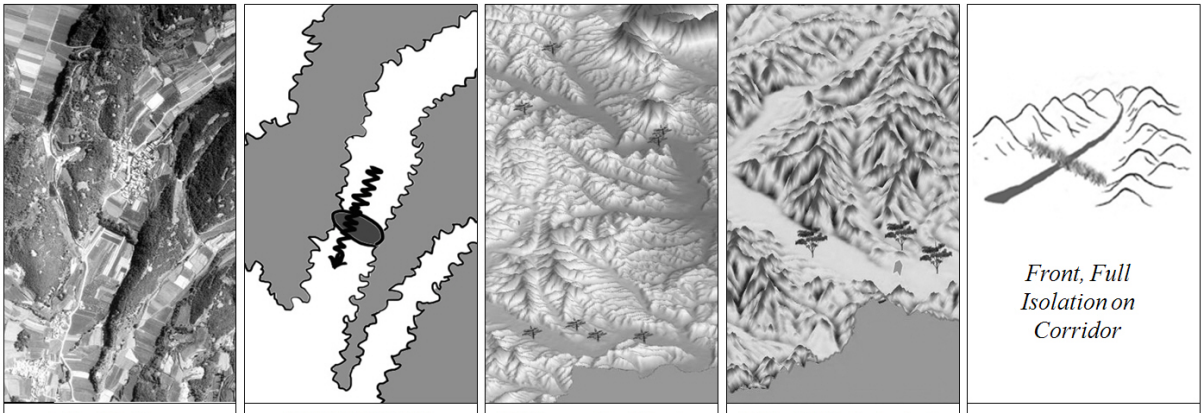

Figure 2. Process of spatial analysis for a location of the Maeulsoop in a unit

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Acknowledgements

The nine prototype landscapes for the study hypothesis were developed from the Ph.D. thesis of Kwon (2002) with financial support of Overseas Research Students Awards Scheme from the Committee of Vice-Chancellors and Principals of UK. Ongoing research for the contemporary and traditional concepts of spatial units in the Korean mountainous landscape have been carried out as a research project at KFRI since 2003.

BEYOND THE TRADITIONAL-SCIENTIFIC KNOWLEDGE DIVIDE: MULTI-ACTOR KNOWLEDGE SYSTEMS AND DELIBERATIVE INTERFACE IN NATURAL RESOURCES MANAGEMENT IN NEPAL

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Introduction

Despite a recent upsurge of participatory innovations in development actions (Chambers 1997) and natural resource management, there is a continuing concern over limited real achievement in terms of local livelihoods outcomes, economic contributions and natural resource sustainability (Cook & Kothari 2001, Edmunds & Wollenberg 2002, Colfer & Capistrano 2005). In many situations, collective processes of institutions and policy fail to address the opportunities to optimize individual and collective benefits from natural resource governance practices. One of the consequences of such failure is that a vast majority of the world's poor who continue to live at the interface between land, forest and water, often have limited access to such vital resources (Scherr et al. 2004, Sunderlin et al. 2005). This reality, to a significant degree, is related to how and to what extent diverse groups of social agents, often with different and competing systems of knowledge, deliberate over decisions and practices of natural resource governance.

In recent years, knowledge systems have become central areas of concern for researchers, policy makers, development activists and practitioners striving for improving natural resource governance (Blaikie et al. 1997, Sillitoe 2006). Despite such concerns, there is still a lack of consensus on basic issues such as how and where knowledge is produced, disseminated, and applied in natural resource management practices. Given the ongoing debate on such questions, we drew upon critical, theoretical insights of Bourdier and Habermas and undertook an empirical research to understand knowledge systems in natural resource governance in Nepal. The overarching research questions included:– how diverse knowledge systems mediate the outcomes of equity, efficiency and sustainability in natural resource management; how different actor's knowledge systems emerge in relation to the practices of governance, and when and how various types of actors engage in deliberative interfaces. We combined Bourdieu's cultural theory of action (Bourdieu 1977, Bourdieu 1984) and Habermasian perspective of deliberative politics (Habermas 1996) in the analysis of empirical information generated by the study..

Methodology

We investigated knowledge systems at three different levels (local, sub-national, and national), in three different sectors (forest, agriculture, irrigation), across four categories of institutions (government, donors, civil society and local communities). At the local level, emphasis was to understand how community groups, households, and individuals who belong to different wealth categories, gender and ethnicity engage in, and benefit from, managing knowledge. In doing this, four Forest User Groups (FUGs) and two Water User Groups (WUGs) were selected at the local level to represent three distinct ecological zones - Tarai, Middle Hills and Mountains of Nepal. At sub-national level, contribution of Federation of Community Forestry Users, Nepal (FECOFUN) in relation to democratizing power and knowledge dynamics has been examined while at the national level, Nepal Agricultural Research Council and the case of community forestry inventory policy were investigated.

Findings

Our research challenges the dichotomy of traditional versus scientific knowledge in natural resource governance, and proposes to identify different systems of knowledge based on the cultural-political standings of the social actors in relation to the practice of governance. We found that change in governance hinges centrally around how these diverse systems of knowledge come into deliberative

interface and to what extent power imbalance among social actors continue to constrain the processes of deliberation. In the context of Nepal, four key categories of social agents corresponding to their relatively distinct systems of knowledge are identifiable – techno-bureaucrats, civil society groups, politicians and development agencies. Box 1 summarizes the key findings of our study.

Box 1. Issues in Relation to Enhancing Deliberation among Diverse Knowledge Systems

- Differences in power, prestige and status among social agents create advantages for some and disadvantages to other knowledge systems.
- Bureaucratic organizations/agents demonstrate significant institutional rigidity to deliberate with citizens in exploring policies and practices of governance.
- Theoretical, generic and reductionist approach of technical specialists do not always go together with the practical, context-specific and problem-oriented perspective of resource user groups.
- There are limited communication and weak information sharing mechanisms.
- There is a monopoly of public institution in production of knowledge.
- There is inadequate recognition of non-governmental research and innovation systems.
- There exist non-transparent alliances of knowledge elites suppressing open deliberation.
- Practices on monitoring, reflections and sharing within and between diverse groups of social agents are limited.
- Rhetorical instruments of participatory approach are often been used to legitimise non-deliberative processes.

The six case studies suggest a number of emerging innovations in the deliberative interface, such as emergence of a federation of civil society groups, participatory mechanisms through which technical specialists and natural resources users work together in undertaking research and devising policies, emergence of critical and reflective intellectual practitioners and civil society activists working to bridge technical and civil society knowledge. Likewise, we have also identified persistent constraints to deliberative knowledge interface, primarily as a result of unequal distribution of knowledge resources in the society.

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STRATEGIES FOR CONSERVATION OF SACRED FORESTS OF KOLLI HILLS, TAMIL NADU, INDIA: A STUDY ON BOTANY, ECOLOGY AND COMMUNITY INTERACTIONS

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Introduction

People have always lived in close association with nature and continue to depend on natural resources for major needs such as food, shelter and medicine. This association and dependence have led humans to treat plants, animals, rivers and mountains as integral part of their cultural life. Many such components of nature have become objects of reverence and veneration. Various mechanisms for natural resource management and conservation strategies based on people's belief and traditional wisdom had evolved over the centuries.

India is ranked as one of the 12 mega diversity rich countries of the world, and is a signatory to the Convention on Biological Diversity (1994). In this regard, numerous efforts have been made by the Government of India to sustain and conserve biodiversity. Conservation efforts through public funds can broadly be classified into two groups: *in situ* conservation pursued through National Parks, Protected Areas, Biosphere Reserves and World Heritage Sites, and *ex situ* conservation pursued through Botanical and Zoological Gardens and Gene Banks. While the above are widely recognized efforts, conservation in the public domain – Community Conservation or *in situ* conservation by rural and tribal women and men remain largely unrecognized and un-rewarded (Swaminathan 2000).

Sacred groves are part of a landscape, often a forested ecosystem, with well defined geographical features, delimited and protected by traditional societies for cultural and religious reasons (Ramakrishnan *et al*. 1998). These groves are protected through customary taboos and sanctions, with significant cultural and ecological implications; the protecting institution may be the priest, a temple trust, or the community as a whole (Gokhale 2001). Protection was reinforced by recognizing them as the focal point for varied levels of social interaction (Ramakrishnan *et al*. 1998). Traditional belief and value systems supporting sustainable management of natural resources and their conservation have disintegrated in the last few decades, thanks to modern developments that has gradually led to control and manipulation of the natural resources in the Sacred Forests.

Setting

Kolli Hills is located in the extreme eastern part of the Namakkal district. It falls within the following coordinates, Longitude: 78°17'05''E to 78°27'45''E and Latitude: 11°55'05''N to 11°21'10''N. The total block area is 441.41 sq.km. The altitude of the hill ranges from 180 m at the foothill to 1415 m at the plateau. The hill range stretches 29 km from north to south and 19 km from east to west. Kolli Hills has an area of 28 293 ha. Human habitation is spread out into 247 hamlets.

The inhabitants of Kolli Hills are known as *Malayali*. They constitute more than 98% of the total population (33 888) of Kolli Hills, living in 6840 households as per the 1991 census of which the tribal families constitutes about 6613. History of *Malayalis* shows that they are the principal inhabitants of the Talaghat Hills, their chief settlements being Shervaroys, Kalrayans, Chitteris, Kollimalais and the Pachamalais. They originally belonged to the Vellala caste of cultivators and have migrated from Kancheepuram to the hills when the Muhammadan rule was dominant in South India (Thurston 1909). The invasion and the settlement of *Malayalis* is a crucial point in the ecological history of Kolli Hills. *Malayalis* brought agriculture to Kolli Hills, which led to periodic manipulation with partial domestication of resources. During the process of their settlement these *Malayali* tribal people have left a patch of

forest nearby their settlement for veneration of their gods, goddesses and ancestors. These relicts of the past vegetation are known as *Sami Sholai* in Kolli Hills.

Sacred Forests (SFs) in Kolli Hills

These Sacred Forests (*Sami Sholai*) are found in the midst of varying agro ecosystems, forest boundaries on hilltops and slopes, distributed across the geographical area of Kolli Hills. SFs size ranges from 1–5 ha. During the field survey, around 240 sacred groves have been recorded. Of these, according to the people, 80% of the SFs had a lush forest cover earlier and now becoming just merely a sacred place. Due to the changing social conditions, the size and structure of the SFs are being altered. Ancestors, Mother Goddesses and Sancritized God (Peruman) worship are more prevalent in SFs of Kolli Hills. Many of the SFs are managed by individual family, traditional panchayat in *Patta land as* well as in *Poromboke* land as common property. Some of them are found in the territory of reserve forests. SFs of Kolli hills harbor several rare and endangered species of Eastern Ghats of India. Rare species like *Myrstica dactyloides* Gaertner, *Persea macrantha* (Nees) Kostern, *Philicium decipens*, *Canarium strictum* Roxb, *Alseodaphne semecarpifolia* Nees, *Ammora rohituka* (Roxb.) Wight & Arn, *Agalaya eloignoides* var *courtalensis*, *Elaeocarpus serratus* L, *Lannea coromandalica*, *Michelia champaca* L, *Tooona ciliata* M.Roemer are found in the SFs. These relict forest patches have been conserved by *Malayali* tribal community through their traditional forest related knowledge (TFRK) and control mechanism by evolving several taboos and regulations that are described in this paper.

These relict wild patches are the repository of several medicinal plants and source of non-timber forest produce for the community. They serve as perennial source of water for nearby agricultural farmlands. These SFs are the place for community gathering during festivals. Although several taboos and believe systems of the people protected these remnant forests, these groves are facing threats now. The survival of the existing SF patches has becoming questionable due to various factors (Box1).

Box 1: Threats to the Sacred Forests in Kolli Hills

- Encroachment of SFs due to Commercial agricultural crops like tapioca
- Introduction of economically important plants such as *Coffea arabica, Elettaria cordamomum*, *Piper nigrum, Ananas cosmosus* in certain SFs
- Invasion of alien weeds such as *Lantana camera, Parthenium hysterophorus),* which replaces native plants
- Natural death of old lofty trees *vis-a-vis* poor regeneration of wild saplings
- Removal of weeds along with wild saplings of native trees during festival time
- Mass worship and raising interest towards constructing a temple in place of a deity
- Dilution of traditional belief systems due to formal education and increasing economic status
- Declining interest in protecting plants and erosion of Traditional Forest Related Knowledge among younger generation.

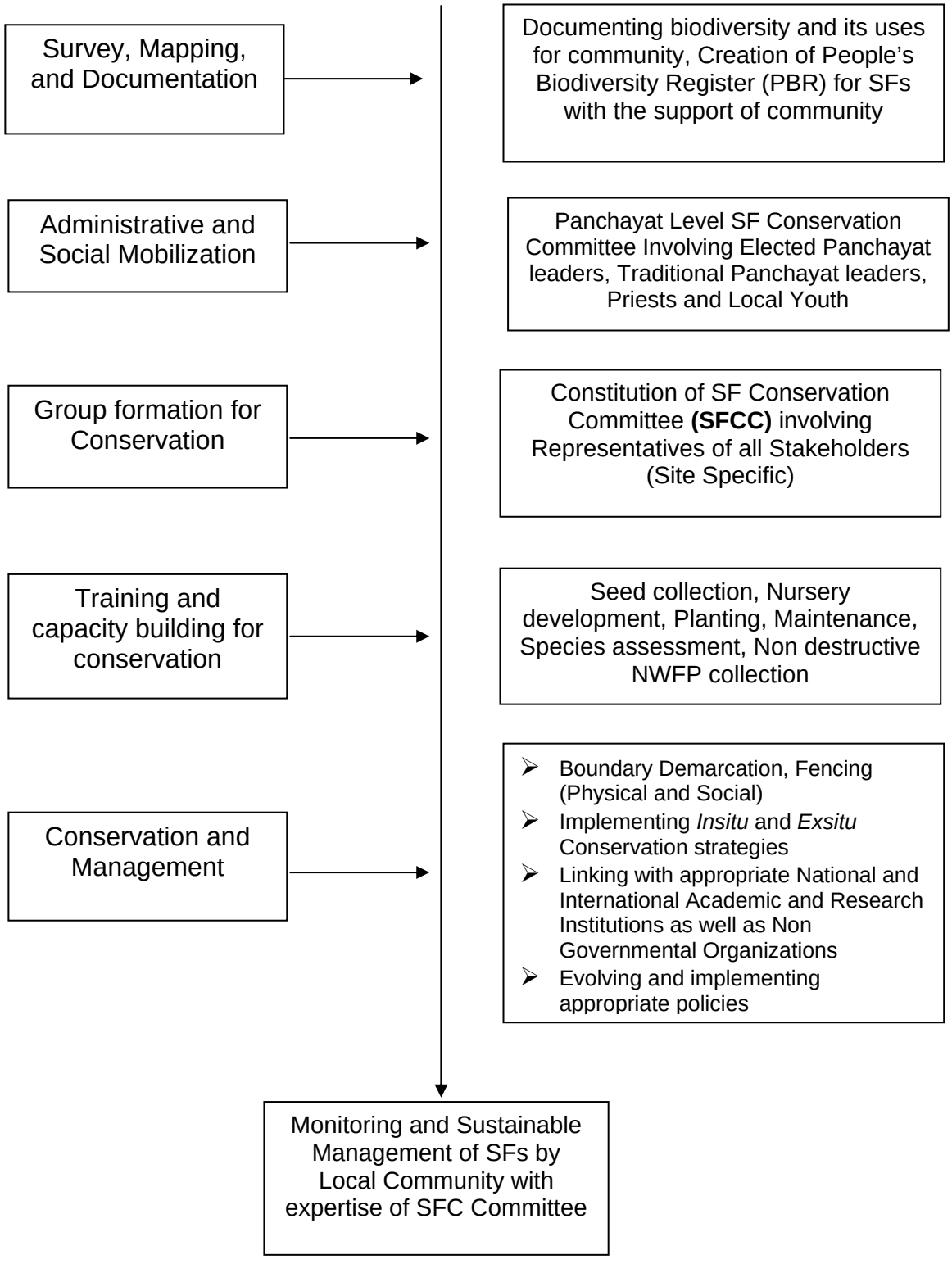
There are several stakeholders that are interacting with the SFs directly or indirectly for various reasons. This paper classifies the actors who are the responsible for existence and as well as rapid changes in the status of SFs in the Kolli Hills. The current trend shows that a participatory conservation approach is essential for conservation and sustainable management of SFs in Kolli Hills.

Though the study shows that the SFs in Kolli Hills are degrading rapidly, they still represent the only patches of vegetated areas in the highly altered landscape of the hill top plateau. These relict patches, according to the present study, harbor several native tree species, some of them are threatened. These relict SFs play a key role in maintaining the soil health and serve as watersheds. They are the only patches of diversity located in large stretches of monocrop fields. Hence, conserving these SFs is essential and requires urgent attention. However, the traditional institution that evolved and managed

the SFs has considerably weakened along with the traditional conservational values. There is a necessity to engage new community institutions to conserve the SFs.

Strategies for Sustainable Management of Sacred Forests in Kolli Hills

A Suggested Approach for Conservation (After E.D. Israel Oliver King 2005)



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THE PROTECTION OF TRADITIONAL KNOWLEDGE FROM COMMERCIAL EXPLOITATION AND INCOME GENERATION IN THE WESTERN GHATS, SOUTH INDIA

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Introduction

Along the west coast of India - beginning from the Surat Dangs at the western extremity of the Satpuras in south Gujarat, for over 1500 km to the southern tip of India in Kerala - stretch the Western Ghats, a mountain range second only to the Himalaya in magnificence. About 30% of the area of the Western Ghats is forested. The region faces increasing stress from population, submergence of forests areas by river valley projects, encroachment and clearance of forest lands for raising plantations and shifting cultivation. The tribal and rural poor have had to pay the most severe price in terms of their diminished quality of life. Inequities and social injustices merely exacerbate the situation as forest-consuming projects such as river dams and mining operations are mooted each day.

Most of the forest cover of the Western Ghats has disappeared. The few remaining stretches of natural forests and protected areas, however, still house a biological wealth matched only by the North-east of India. The Western Ghats Zone covers only 5% of India's area, but 27% of all the species of higher plants recorded in the Indian region are found here (about 4,000 of the total 15,000 species). Almost 1,800 species are endemic to the region. Several interesting plant associations are observed in the evergreen forests of the zone. There are montane *shola* forests, riverine or swamp forests and nearly half a dozen other evergreen species associations, mostly observed in the southern half of the zone, where numerous ancillary mountain ranges converge to produce a region of exceptional diversity.

Strategies and Initiatives for the Protection of Traditional Knowledge

Biodiversity registers

One of the 18 biodiversity "hot spots" of the world, the state of Kerala is developing strategies to shield its rare plant and animal species from corporate exploitation. Kerala's mountain forests are home to some 2,800 species of flowering plants, of which 900 are used in India's centuries-old medicinal system known as Ayurveda. The rich variety of plant species found on the State's farms and the coastal mangroves also have commercial value. State authorities have decided that the best way to prevent outsiders from staking claim to this traditional knowledge is to assert the legal rights of the people of Kerala over it first. The government wants the people themselves to play the main role in policing efforts to protect their flora and fauna. Elected village councils, known as *panchayats*, will have the main responsibility. The way is being shown in Eranakulam, where the panchayat has prepared a register of the district's plant and animal species. Some 8,600 trained volunteers have collected information on the various uses of the local fauna and flora in 86 villages of the district.

Traditional plant drugs: the case of Trichopus zeylanicus

The biodiversity register scheme is not the first attempt in the state to protect traditional knowledge from commercial exploitation by outsiders. In a widely hailed venture, another Kerala government-backed institution, the Tropical Botanical Garden Research Institute (TBGRI), has helped the state's indigenous Kani community to make commercial use of its traditional medicinal knowledge. For centuries, the tribal people had known of the invigorating properties of a local shrub of the genus *Trichopus* (Dioscoreaceae). Only the indigenous people, the Kani tribe knew of the anti-fatigue properties of the *arogyapacha* plant (*Trichopus zeylanicus*), which they eat during long treks in the hilly Western Ghats region. Tribal healers, known as *Plathis*, have knowledge of the medicinal

properties of the flora and fauna of the region, and each generation passes this knowledge on to the next generation orally. The plant contained certain substances with anti-stress and anti-fatigue properties, and which protect the liver and restore the immune system. TBGRI Scientists had isolated 12 active compounds and produced a scientifically verified and standardized herbal formulation, called *Jeevani*, which was sold to a leading pharmaceutical company. The anti-fatigue properties of the compounds have a lot of potential in sports medicine, and in old age remedies. The National Botanical Research Institute (NBRI), who patented compounds extracted from the plant, share the royalties equally with the tribal community, and revenues obtained from the sale of the patent right were shared equally with the Kani community. Scientific studies had revealed that the medicinal properties of the plant are best manifested in plants growing in their natural habitat.

The Institute, which recently began making profits from the patent, has invested 700,000 Rupees (approximately US$ 15,000) in a trust set up to benefit the tribe's 12,000 members. Kani tribal members comprise 60 per cent of the trust's managing committee. The interest earned from the royalty will be utilized for the welfare of the local people. The unique profit-and-benefit-sharing experiment that the tribal folk have successfully implemented at home has been recognized by United Nations agencies and multilateral financial institutions and a Kani tribal leader had received the United Nations Equator Initiative Prize 2002 at the Earth Summit, Johannesburg for the innovative Kerala Tribal Project on Ethnomedicine.

There is a huge world market for herbal medicines worth billions of dollars and there has been significant financial gain from the commercialization of Jeevani. Arya Vaidya Pharmacy was given a license to manufacture Jeevani for an initial period of seven years at a cost of US$50,000 for the license plus 2 per cent royalty. TBGRI decided that the Kani tribes would receive 50 per cent of the license fee, as well as 50 per cent of the royalty obtained by TBGRI on sale of the drug. The herbal medicine that the pharmacy produced has done well on the market as the demand for the Arogyapacha-based formulation Jeevani boomed, with the bulk of exports going to Southeast Asian and Western countries.

APPLICATION OF TRADITIONAL KNOWLEDGE IN FOREST MANAGEMENT: ETHNOBOTANICAL INDICATORS FOR SUSTAINABLE FOREST USE

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Introduction

Forest management has been usefully defined in terms of protection, utilization and distribution of products and the institutional or organizational arrangements by which they are carried out, with both technical and social aspects of forest management treated as part of single system (Fisher et al 1989). Tamang (1990) considers the scope of forest management as covering harvesting, distribution, protection and planting practices.

Forest management systems are localized systems which form a basis for decision-making for rural people, since the majority of forest management systems in developing countries operate under the traditional knowledge of indigenous people. Therefore, traditional knowledge is not only of value for the cultures from which they evolve, but also for scientists and planners striving to improve livelihoods in rural societies, therefore traditional knowledge system has global significance for the management and sustainable use of forest resources.

Scientific Understanding on Traditional Knowledge

The World Conference on Sciences (WCS) organized by UNESCO in cooperation with the International Council for Science (ICSU), was convened in Budapest, Hungary, June 26-July 1, 1999. The term Traditional Knowledge is defined by ICSU as: *...a cumulative body of knowledge, know-how, practices and representations maintained and developed by people with extended histories of interaction with the national environment. These sophisticated sets of understandings, interpretation and meanings are part of and parcel of a cultural complex that encompasses language, naming and classification systems, resource practices, ritual, spirituality and world-view* (ICSU 2002).

Traditional knowledge in the Convention on Biological Biodiversity (CBD) context refers to knowledge, innovations and practices of indigenous and local communities deriving from customary uses of biological resources and associated cultural practices and traditions. Traditional knowledge is a body of knowledge and beliefs transmitted through oral traditions and first hand observations about the local environment, and as a system of self management that governs resources use, and plays important role in sustainable development of the world today.

Today sustainable management of forest is a critical issue in world environment and natural resources management as global forest resources are continuing to decline, global climate change is accelerating and rural poverty remains a major issue in many developing countries. On the other hand, traditional knowledge systems for forest management are disappearing rapidly in many indigenous communities of the world. Greater understanding, recognition, respect, and protection of tradition knowledge systems is urgently needed to save the forest, the environment and people of this planet.

Yunnan as a Region of Rich Bio-cultural Diversity

Yunnan is well-known in China for its rich biodiversity. The geographical diversity of Yunnan, from tropical lowland (alt. 76 m) to alpine (alt. 6674 m), creates various forest ecosystems such as tropical rain forests mountain evergreen forests, alpine dark coniferous forests and savanna type of forest-grass land. Of the 17,000 species of plants recorded in Yunnan half of these occur in forests of different types. Rich genetic diversity has resulted from both natural evolution and human manipulation of ecosystems, including forests, through history. Furthermore the cultural beliefs and practices of indigenous people have resulted in modifications of the landscape environment, creating a high diversity of landscape pattern.

Yunnan is characterized by very high cultural diversity with diverse cultural distribution patterns ranging from Himalayan to Southeast Asian societies. Among the 48 million population inhabiting the 380,000 km² land area of Yunnan one-third of the population are ethnic minority people belonging to 25 cultural groups, distributed in a mosaic pattern in this mountainous province. Many of ethnic groups are forest people, practicing gathering, hunting and cultivation of forest resources. All ethnic groups exhibit a high dependency on forest resources for their livelihoods including fuel, fodder, timber, medicine, supplementary food, typically engage in harvesting of non-timber forest product (NTFP), agroforestry, shifting agriculture and worship of sacred forests for their spiritual needs. Traditional knowledge of forest management is an essentially part of their cultures, contributing to the rural economy and to ecosystem management.

From scientific point of view, the overlapping distribution pattern of forest plant diversity and cultural diversity in Yunnan provides excellent geographical locations for study people-forest interactions and traditional knowledge for utilization and maintenance of biodiversity including forest diversity. However, the past half century, the impact of rapid economy development and globalization have brought about critical challenges for the environment, biodiversity and traditional culture. Natural forests are declining, biodiversity is threatened, forest-lands are being converted for economic uses; exotic and invasive species are increasingly occupying habitats of indigenous species; and traditional knowledge systems of forest management are being lost among indigenous communities in all ethnic groups. Hence, sustainable use and management of forest resources is not only important for conservation, combating global warming and for maintaining traditional cultures, but also critical for rural poverty reduction, particularly in ethnic minority communities and marginal societies.

Ethnobotanical Indicators of Sustainable Use of Forest

Ethnobotany is a scientific field of studying human interactions with plants and their environments, emphasizing traditional use and management of plants in various ecosystem by different cultures through history. Forest ethnobotany has been an essential subject in the field ethnobotany, which contributes to investigation, documentation and quantitative assessment of traditional knowledge and practices in forest use and management by traditional societies in different regions. Through many years of ethnobotanical studies in forest areas of Yunnan of China, some Southeast Asian and Himalayan countries, sustainable use of forest and plant resources could have been observed and monitored using ethnobotanical methods and approaches (Pei 1995, 1996, 2002, Pei & Huai 2007, Pei *et al*. 1993, 1996,). Ethnobotanical monitoring systems can be established for sustainable use and management of forest in local community on the basis of traditional knowledge. Ethnobotanical indicators of sustainable use and management of forest resources may involve the following aspects:

1. Status of traditional knowledge on folk classification, identification, naming of plants and ecology of plants in the environment surrounding the community.
2. Level of diversity of plant use for food, fodder, shelter, timber, fuel, energy, medicine, NTFPs, income generation and cultural uses for livelihoods in the community
3. Use of genetic resource diversity in agroecosystems in particular settings; e.g., home garden, farming crops, wild cultivation, agroforestry, intercropping, etc.
4. Status of traditional practices on wild harvesting and their management practices e.g., arrangement of use, plant parts, location and seasonal collection, village regulations on wild harvesting.
5. Maintenance of traditional cultural understanding and practices in preserving plant diversity and approaches to forest, plant worship, taboo, sacred forest, totem, ethic and moral restrictions that are still existing within communities.
6. Community participation in forest resource management, in which traditional knowledge provides the basis for local level decision-making about aspects of day to day life, e.g., community organization, social norm and regulations on forest management.
7. Position of social mechanism for inheritance of traditional knowledge and traditional medicine from generation to generation by oral, demonstration and cultural symbols, and traditional herbal medicine systems maintained in the community.
8. Position of traditional agroforestry and tree planting practices, in particular those using of local tree species for afforestation in community land areas.

9. Position of community institutions for decision-making in managing forest and land use, as well as governing of forest and land tenures and development interventions.

The ethnobotanical indicators proposed in the above for monitoring of sustainable use of forest resources shall be further developed by ethnobotanical quantitative methods and ranking index systems for on-site measurements and ranking to determine the degree of sustainability of forest resources use in a particular setting of rural society in a given area. It is therefore recommended that further research activities on the monitoring indicator system be carried out and further developed.

Discussion

1. Traditional knowledge systems are important for modern societies, not only because TK itself is a cultural heritage meriting protection but also because of its great value for modern development, especially in regards to the sustainable use of forest, ecosystem management, and poverty reduction.
2. Traditional knowledge systems and the modern scientific knowledge system (SKS) are not exclusive and do not conflict with each other, but rather should be complementary, interactive and cooperative each other in modern development and conservation.
3. Respecting, maintaining and protecting of Intellectual Property Rights (IPR) related to traditional knowledge are essential, and actions are urgently needed to document, identify and evaluate before it is lost. Ethnobotany is in a position to make significant contributions towards these objectives.
4. Establishment of legal systems for protection of Intellectual Property Rights of traditional knowledge should be considered by governments.
5. Towards more equitable partnerships, forest stakeholders involved in forest resources management and genetic resources conservation should establish close collaboration to develop and promote implementation of agreements acceptable to all parties for the use of traditional knowledge and forest resources

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PERCEPTIONS OF SCLEROPHYLLOUS EVERGREEN OAK FOREST BY INDIGENOUS COMMUNITIES IN NORTHWEST YUNNAN, CHINA - CONSEQUENCES FOR SUSTAINABLE FOREST MANAGEMENT IN MOUNTAINOUS REGIONS

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Introduction

In most developing countries, the livelihoods of rural people highly depend upon natural resources, especially the harvest of forest products. Broad-leaved sclerophyllous forests occur in areas with a Mediterranean-type climate: winter rain and summer drought (Gower *et al*. 2003). Although the climate in Northwest Yunnan is characterized by warm rainy summer and cold dry winter, one group of evergreen sclerophyllous oaks (*Quercus* sect. *Heterobalanus* (Oerst.) Mentis) grow here and comprise the dominant vegetation in sub-alpine Hengduan mountain ecosystems (Liu *et al.* 1984). Oak species characteristics and the general structure of these forests are very similar to Mediterranean oaks such as *Q. ilex* from ecological, morphological and molecular evidence (Zhou *et al.* 2003, Tang 2006). Indigenous Tibetan people manage and harvest the oak forests products based on traditional culture. Because of the above, sclerophyllous oak forests has consistently been ranked as an important protection target in plans for this region, such as “The Plan for Protection and Development in Northwest Yunnan” (informally published in 2000 by TNC and Provincial government). The purpose of this article is to provide detailed information about how indigenous communities in fact perceive and relate to the oak forests in which they live and on which they depended. It can help to understand how these forest resources have been utilized and managed, as well as how the oak forests respond under different management regimes. Furthermore, results of this research can assist in ensuring sustainable management of this natural resource in the future.

Methodology

Northwest Yunnan located in the southern mountain region (Hengduan Mountains) of the Eastern Himalayas, is well known in China for its biological and cultural diversity. And it is designated as one of global biodiversity hotspots too (Myers *et al.* 2002). The quantitative data upon which this paper is based were collected from two villages and one township in Deqin County of NW Yunnan. Participatory Rural Appraisal (PRA) methods and ecological investigation methods were conducted. Group mappings, historical narratives, key person interviews and structure questionnaires were used for understanding how oak forest resource has been used and managed by local Tibetan. Based on group mapping result, some segments of oak forest were selected around the village where local people had lots of activities as forest investigated plots for evaluation the oak forests response. Correlation analysis was introduced to determine main use type and their relationships with economic development level of village. Important value index and cluster analysis was used to distinguish forest used types. Oak forests response was indicated by population size structure (DBH class).

Results and Discussion

Usages

The oak forests are serving as an essential natural resource for local inhabitants in this region. Use and products are diverse, including fuel-wood, fences, agricultural tools, fertilizers, religious functions and grazing. Acorns, used to make wine and other non-timber forest products are harvested for cash income and traditional medicines. Correlation analysis result (Figure 1) showed that fuel-wood, fertilizer, agricultural tools and non-wood forest products harvest are main use types. The oak forest is used intensively in lower developed village. People lives in township seldom use it.

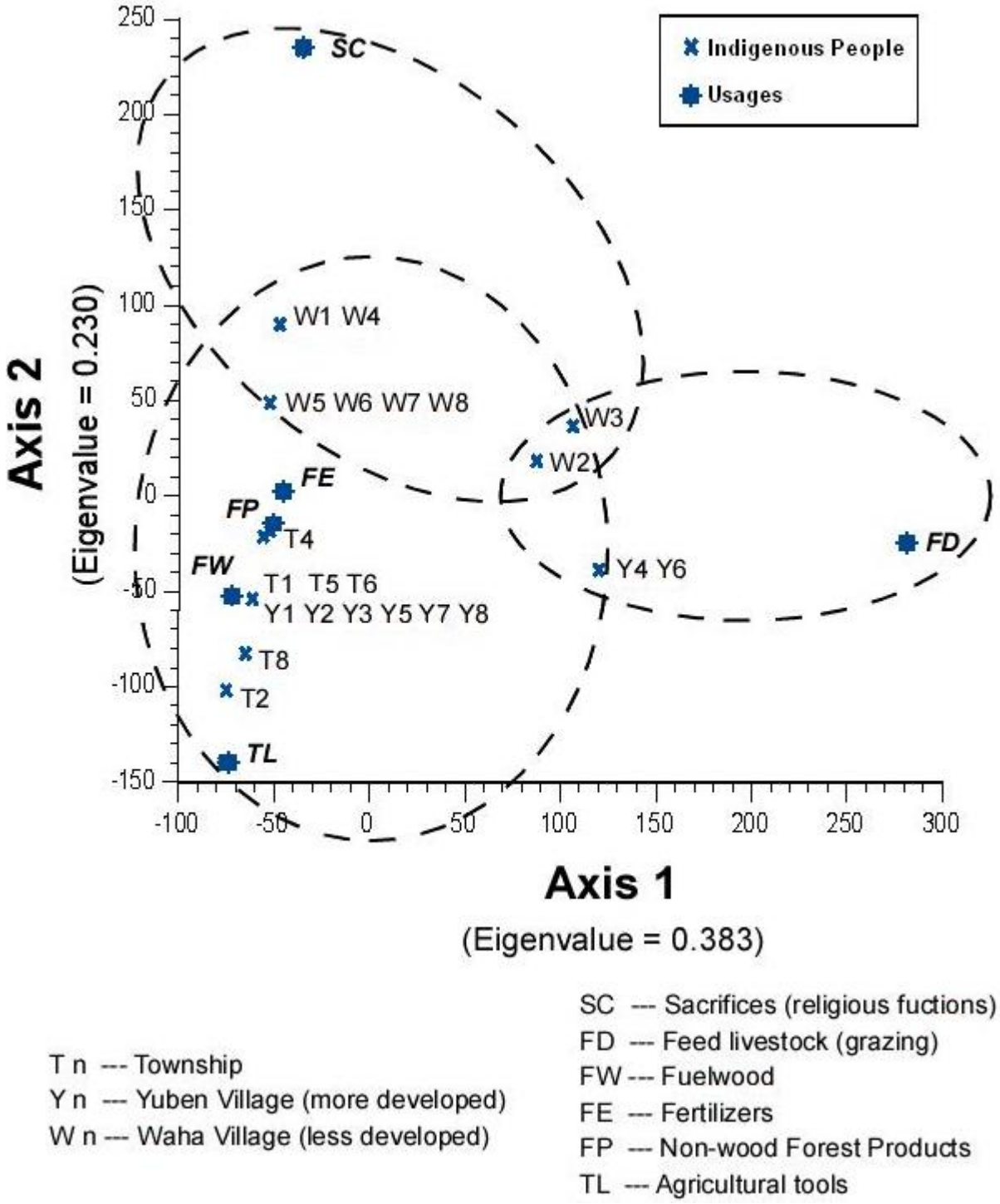

Figure 1. Correlation analysis of use types and their relationships with economic development level of villages

Management

In this region, forest management depends on government policies and community rules. Most of the oak forests distribute in community forest area and are managed by indigenous communities according to their traditional culture and religion. Three categories were distinguished: water resource protection forest, fuel-wood collection forest and organic fertilizer collection forest. However, traditional forest managements are changing due to several factors: government policy, increasing development in the area, and expansion of demand for forest products.

Forest response

Cluster analysis (Figure 2) showed that the characteristics of oak forests vary with different management regimes. The population structure of oak trees is different too (Figure 3). Water resource protection forest features few juveniles. Fuel-wood collection forest can be modeled with a typical inverse "J" growth model. Forest used as a source of fertilizer has many sprouts but short of mature individuals and seedlings.

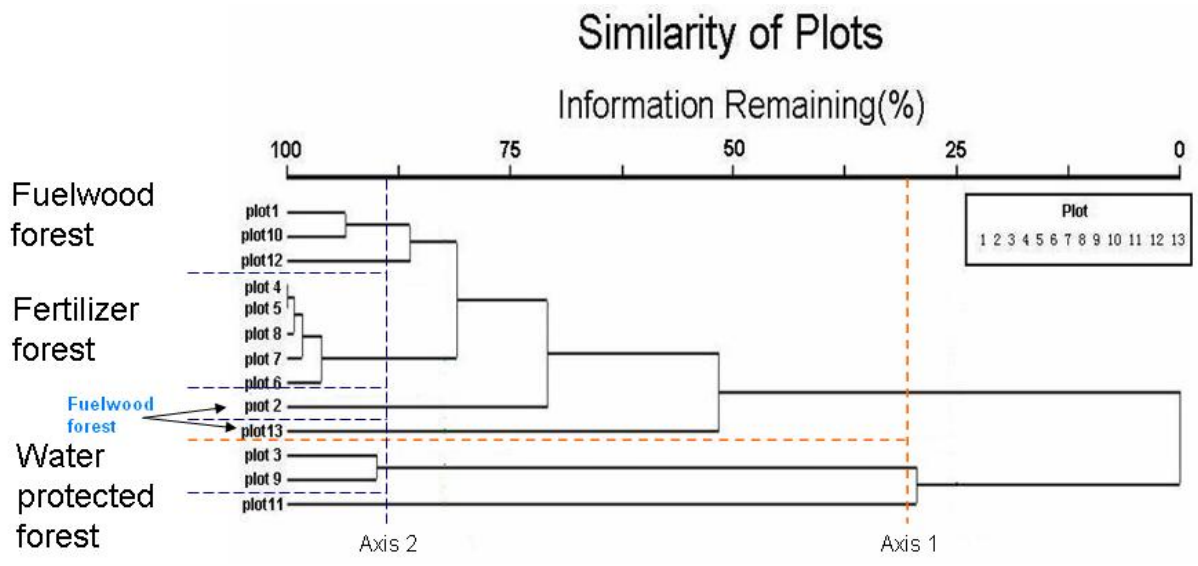

Figure 2. Cluster analysis of different used types of oak forest using index of overstory species' Important Value

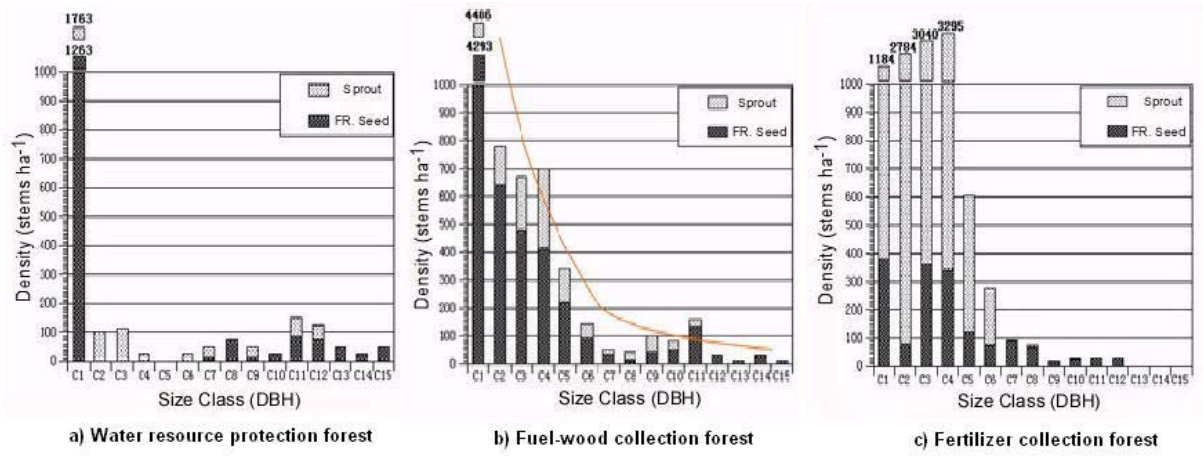

Figure 3. Oak population size structures of three management categories

Sustainable Forest Management

As some researchers' apprehension (Tang 2006), the healthy survival of the oak forests in NW Yunnan is threatened by fuel-wood production rising. However, we found that the ongoing main protection strategy used so far, an alternative energy program, is not sufficient. Thus, we argue for the need to develop a new paradigm of sustainable forest management which integrates and more fully takes into account traditional perceptions of the forest by mountain communities.

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TRADITIONAL PRACTICES ON THE UTILIZATION OF KAKAWATE - *Gliricidia sepium* (Jacq.) Kunth ex Walp. - FOR SUSTAINABLE DEVELOPMENT IN THE PHILIPPINES

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Introduction

Kakawate (*Gliricidia sepium* (Jacq.) Kunth ex Walp.) whose common names include *madre de cacao* (Sp.), Mexican lilac (Engl.), *bunga Jepun* (Malay), *gamal* (Indonesia), quick stick (Jamaica), cocoite (Central America), mata raton (Ecuador), is a medium sized tree originally from Mexico and Central America that is now introduced and naturalized in many tropical and subtropical regions worldwide. It may be either a single or multiple stem tree with trunk diameters reaching 30 cm and attaining a height of up to 15 m. The bark is grayish-brown to whitish and may be deeply furrowed on old, large diameter trees. Leaves are pinnately compound, alternate in arrangement and 20 to 30 cm in length. Leaflets are generally opposite in arrangement, oblong in shape and pointed at the tip. On some specimens leaflets may be elliptical with rounded tips. There are 7 to 25 leaflets per leaf and size increases towards the tip. Leaflets are 40 to 80 mm long and 20 to 40 mm wide (Lavin 1996).

In the Philippines where the climate is distinctly dry and wet, *kakawate* grows robustly and abundantly. In the mountain and rural areas, it is a very important resource for it provides the daily household requirements and livelihood of the people. A renewable resource, its versatility ranges from food, feedstuff, medicines, antimicrobials and botanopesticides, biofertilizers, ripening agents, fuelwood, components of ceramics, absorbents and deodorizers. Rabena (1996) studied *Gliricidia* leaves and isolated, characterized and identified a novel compound coumarin , ($C_9H_6O_2$), a chemical that kills *Microcerotermes losbanosensis,* a termite endemic to the Philippines. Rabena and Cachola (1998) further discovered that *Gliricidia* coumarins inhibited the growth of fungus *Trichophyton mentagrophytes*. In 2004, Rabena and Rodillas utilized the leaves as botanopesticides and biofertilizers in rice paddies which improved yield. Raboy *et al*. (2005) further utilized it with neem (*Azadirachta indica)* leaves as pesticides in growing corn intercropped with peanuts and eggplants. Lagmay (2007) tied Gliricidia branches containing leaves on bed posts in eradicating bed mites. Leaves contain *ethylene* vapors that kill pests. Rabanal (2006) verified its uses by feeding the leaves to pigs and removed their worms.

The tree occurs and grows well in natural stands in mountainous areas in the Philippines, where it is often found on ridges. They are evergreen both during the dry months of November to May and the wet months of June to October. The tree is planted and cultivated on plains in both arable and non-arable areas in the Philippines. Backyard propagation of *Gliricidia* is evident in the countryside which completes the rural landscape.

The objectives of this study are:

1. To identify the traditional practices on the utilization of the *Gliricidia sepium* for poverty alleviation in the Philippines.

2. To promote the use of these practices in locations where *Gliricidia sepium* grow.

Methodology

The practices were documented using personal interviews. The interviews are further validated by actual observations of the practices on sites. The results are studied and analyzed.

Results and Discussion

Propagation

Traditional knowledge and practices on the utilization of *Gliricidia sepium* play a key role in the rural economy. A wide range of knowledge include the propagation of the tree using appropriate plant parts for propagation. In the northwest island of Luzon, Philippines, people in the community plant *Gliricidia* using the stem. In both house lots and fields, landowners use it for live fences to protect their properties or crops. They are planted 1-2 m apart joined by bamboo or barbed-wire. *Gliricidia* is also planted at closer spacings (10-15 cm) to form dense hedges for multiple uses.

Table 1. Gliricidia plant parts used for propagation and intended use.

Plant Part	Diameter (inches)	Main purpose	Other Purpose/s
Large Bole	5 - 7	Fence	Prime post
Medium branch	3 - 4.5	Fence to protect from astray animals & people	Vegetative ventilation-fresh source of air
Small stems	1- 2.9	Fence to protect from small animals like goats, poultry, etc	Planted in between big posts to serve as cover; Fresh source of air

Construction and Anti-termite Use

Gliricidia wood is widely used for construction material in the rural communities. For temporary structures like houses such as the rural Filipino *bahay kubo* , the stem wood is used for posts . Smaller diameter wood is used as auxiliary support in sheds, wood garages and many miscellaneous constructions.

Fodder and Vegetable

The leaves and flowers are widely used in homes for food, and as feed for livestock and ruminants. The flowers, gathered from January to April, are cooked to prepare a vegetable salad mixed with chopped fresh tomatoes. *Gliricidia* produces abundant amounts of nutritious fodder containing 18 to 30% crude protein. Leaves are gathered and fed to large as well as small ruminants, including goats, sheep, cows and carabaos. Livestock naturally limit their consumption - large ruminants manifested self inhibition upon eating 5-6 branches (4 -5 ft) of *Gliricidia* freshly cut from standing trees. Goats showed inhibition after consuming more than 4 leaf-bearing branches of similar lengths when the animal grazed in hot weather conditions.

Ripening Agents

Kakawate leaves are often used as ripening agent for bananas and other fruits, a safe and environmentally friendly substitute for hazardous chemicals otherwise used for this purpose. In traditional practice, the leaves of *Gliricidia* are placed on green but matured bananas to promote their ripening. Twenty grams of fresh leaves placed with 2 kg of unripe bananas promoted ripening within 2 days, while it ordinarily takes 5 days for the same amount of bananas to ripen without *Gliricidia* leaves. In the absence and presence of ventilation, under similar original conditions, ripening is also enhanced in bananas covered with cloth, producing fruit with a more prominent yellow color in the samples having poor air circulation.

Table 2. The effects of ventilation and kakawate (*G. sepium*) leaves on the ripening of bananas.

	Mass of Bananas (kg)	Amount of G sepium leaves (kg)	No of days to Ripen (Days)
Gliricidia leaves, without ventilation	2.0	0.02	1.5
Gliricidia leaves with ventilation	2.0	0.02	2

Fuelwood

Wood of *Gliricidia sepium* tree is hard and durable. It has a specific gravity of 0.5 to 0.8, and makes a good fuel, burning with little smoke and no sparks, with a calorific value of 4,900 kcal/kg. As fuelwood, a lesser quantity of it is needed to cook food thus it is a cheaper source of energy for households. In cooking rice, four cups of rice requires 1.5 kg of *Gliricidia* fuelwood vs 2.0 kg of fuelwood from narra *(Pterocarpus indicus)*. *Gliricidia* fuelwood is much preferred by gatherers because it is easy to collect from low-branching, medium-sized, trees. The absence of thorns and spikes on its stems, branches and leaves are beneficial characteristics of *Gliricidia* which facilitate collection of its wood.

Medicine

Kakawate is a valuable resource in the field of medicine and toxicology. Traditional practices make use of the leaves as antimicrobial agents. The leaves are used to eradicate fungi on skin in humans. Traditional practices involved the maceration of the leaves with the extract placed over a cleansed skin disorder. It is considered very effective for *Trichophyton mentagrophytes, Tinea flava* and *Tinea discolor*. Rabena and Cachola (1998) found out that *Gliricidia sepium* leaf extract inhibit the growth of the fungus *Trichophyton mentagrophytes* Domestic and farm animals infected with the fungi on skin showed improvement after *Gliricidia* crude extract application. Traditional practice for treating skin disorders and intestinal worms in pigs involves feeding them *Gliricidia* leaves between meals (usually at nine o'clock in the morning) while the fresh leaves are rubbed on the skin; these measures were found to eliminated skin disorders and reddening progressively, while intestinal worms were expelled with their feces.

Botanopesticides and Biofertilizers in Agriculture

In agriculture, kakawate is used as a botanopesticide for the eradication of riceweevils and pests in rice, and for worms and other pests in vegetables and other crops. Rabena and Rodillas (2004) conducted studies to verify traditional practice on the effects of kakawate in controlling and eradicating pests in rice. Traditional practice involves the use of fresh branches as organic fertilizer – these are placed on rice fields and allowed to decay on seed beds and plants. This was observed in Naglaoaan, Sto. Domingo, Ilocos Sur and Rugsuanan, Vigan City, Ilocos Sur.

Traditional practices involving *Gliricidia* are also used for the preparation of rice fields. The young branches containing leaves are put into the soil, plowed under and allowed to decompose and detoxify. Upon planting the rice seedlings, the remaining branches are removed. The total number of days before harvest is divided into three to determine and to estimate the actual date of *Gliricidia* botanopesticide application. The application is done by spraying the *Gliricidia* water crude extract on plants. The leaves were chopped and soaked for 24 hours. The following day, the moisture was filtered. The filtrate was sprayed on rice plants and vegetables while the residue was used a biofertilizer.

Components in Ceramics, Absorbent & Deodorizer

In industry, kakawate ash are used as components in the formulation of concrete. In the preparation of clays used for unique designs of ceramics, the ashes of *Gliricidia* show fine black markings which are permanently embedded on ceramics surfaces. Artisans incorporate the ashes with oxides and allowed to flow on ceramics surfaces before firing the clay at 1000^{o}C. Charcoal from *Gliricidia* is also a perfect material for absorbing moisture and foul odors in rooms .

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KNOWLEDGE SYSTEMS: THE BASIS FOR SUSTAINABLE FORESTRY AND LINKED FOOD SECURITY IN THE ASIAN REGION

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There is an increasing realization today that sustainable forestry demands an integrated socio-ecological system based landscape (involving both natural and human-managed ecosystems) management approach that is community participatory. This implies that the pathways for sustainable management should be based on value systems that communities can relate with. Traditional forest knowledge (TFK) therefore provides a good handle to reach out to forest dwellers. The twin issues that are to be tackled are sustainable forestry and the linked sustainable livelihood/development concerns of traditional societies living in the Asian region. Whilst dealing with TFK, what is also critical is to arrive at generalizable conclusions that cut across socio-ecological systems, rather than merely viewing this knowledge base as a restricted 'local knowledge'. TFK is a product of interactions that forest dwellers have always had with biodiversity (in all its scalar dimensions (sub-specific, species, ecosystems and landscapes) around them. What is also being increasingly realized is that conserving/managing biodiversity is critical to cope up with environmental uncertainties, arising from 'global change' in an ecologic sense (Mooney *et al*. 1996) and economic 'globalization' (Ramakrishnan 1999). This is the context in which we have worked with 'knowledge systems' as a powerful connecting link between social and ecological systems that would enable community participation in the area of sustainable forestry linked food security.

Working hand in hand with traditional forest dwellers, an important objective was to systematize and organize TFK, that cut across social, economic and cultural dimensions, on a scientific basis. Communities perceive TFK from the viewpoint of both tangible benefits that may accrue to them but also intangible psychological value derived through the natural cultural landscape that they sculpture around them (Ramakrishnan 2001). Therefore, TFK could be seen to have values that are:

(a) Economic - traditional crop varieties cultivated, lesser-known plants and animals of food value and medicinal plants harvested from the wild are of direct economic benefit for traditional societies and can buffer periods of food scarcity;

(b) Socio-ecological – the way traditional societies conserve and manipulate biodiversity contributes towards ecosystem resilience (by its impact upon hydrological processes within the soil system, and determining soil fertility and nutrient cycling patterns linked with above- and linked belowground biodiversity (Ramakrishnan 2001);

(c) Socio-cultural – by contributing towards intangible benefits that impinge upon cultural, spiritual and religious beliefs.

Arising from these considerations, the biodiversity around traditional societies could be viewed from the point of view of socio-culturally valued, sacred species, sacred groves and sacred landscapes, with implications for forest biodiversity conservation/restoration (Ramakrishnan *et al*. 1998) and linked sustainable livelihood/development of people living in the developing tropics (Ramakrishnan 2001). Understanding TFK, putting meanings into it and appropriately linking the same with formal ecological knowledge (FEK) that touch upon a whole range of disciplinary dimensions, both biophysical and social is the key for community participatory bottom-up approach towards management of natural resources, both natural and human-managed. In such an effort, women often play a leadership role, since they are the chief custodians of TFK (Ramakrishnan 2007). Thus, to cite a couple of illustrative examples: (i) in the shifting agricultural landscape of north-east India, whilst men take on heavy duties linked with slash and burn operation, women tend to deal with issues linked to crop management and harvest schedule in their mixed cropping system (Ramakrishnan 1992a, 2006); (ii) in the central Himalayan region again, with women playing a key role as custodians of TFK, tried to conserve the socially valued mixed Oak forests; they were in the forefront in hugging the trees (internationally well-known 'chipko') movement when the timber extractors from the plains went to harvest timber for industrial use elsewhere in the plains (Ramakrishnan *et al.* 1998).

However, TEK based approaches alone are not adequate to address societal concern in the contemporary context of rapidly increasing population and declining natural resources. FEK based approaches, through an understating of forest successional patterns and processes (biomass, productivity, adaptive strategies of species and populations, nutrient cycling patterns and processes, etc.), were seen as critical inputs to arrive at relevant appropriate technologies directed towards conservation linked sustainable livelihood/development. The need of the hour is to have 'hybrid technologies' based on appropriate linkages to be worked out between 'formal knowledge' derived through a hypothetico-deductive process and scientifically analyzed 'traditional knowledge' that traditional societies have generated through an through an experiential process (Ramakrishnan *et al*. 2005).

Broadly speaking, this linkage between the two knowledge systems towards conservation linked developmental pathway could work at three levels of integration, depending upon the level at which socio-ecological systems are currently functional:.

1. The very traditional forest dwellers, for example, still remain attached to, and see themselves as a part of the natural cultural landscape in which they are located. This therefore implies that the rich TFK that they possess is to be seen as the basis for an '*incremental pathway*', building upon the 'scientifically analyzed' TFK step by step in an incremental fashion, and bringing in FEK only to a limited extent as appropriate (the incremental pathway); eg., shifting agricultural landscape redevelopment plan operationalized in the State of Nagaland, in north-east India (Ramakrishnan 1992a, 2006). In the north-eastern regional context which is rich in ethnic diversity, TEK could be seen to extend into the realm of institutional arrangements too – locally based traditional institutions being appropriately integrated with the modern ways of institutions formed through an elective process.
2. Working in the Central Himalayan region and elsewhere in the rural plains of India and elsewhere in Asia, where the human societies are less traditional (being exposed to pressures from industrialized/industrializing societies), TFK forms an important basis for addressing restoration of natural resources in an already degraded landscape. In many such situations, the local communities are ready to bring in a greater proportion of FEK; traditional knowledge being brought in to adapt the suggested technologies to fit into the given socio-ecological contours in the degraded rural landscape – the '*contour pathway*'; eg., a whole variety of agroforestry system models linked with sedentary mono-cropping systems as in the plains, and/or rotational sedentary farming systems as prevalent in the Central Himalayan landscape (Ramakrishnan et al. 2005) are amenable to this pathway for development.
3. Under many situations where the socio-ecological systems may have already undergone drastic transformations, natural ecosystems and/or human-managed agricultural systems could often be under stress arising from intensified monocropping and/or excessive use of chemical fertilizers, leading to soil exhaustion. Under such situations, creating buffering mechanisms within the soil subsystem through appropriate management of the aboveground linked belowground biodiversity could be seen as the key management issue. Introducing and/or managing socially valued keystone species aboveground, and managing organic residues arising from such one or more such species to enhance soil health and linked belowground biodiversity is the possible pathway to address sustainability concerns. *In situ* management of soil fertility using selected organic residues, using carefully identified and managed earthworm species within the soil subsystem as markers and if need be introduced and cultured *in situ* within the soil sub-system, could be the '*quick-fix*' pathway to ensure sustainability of the given ecosystem/landscape. In other words, the emphasis is either on indirect in-soil (with organic residue inputs but without earthworm inoculation) and direct (with organic residue inputs and earthworm inoculation in-soil earthworm technology, to improve soil health and aboveground biodiversity/productivity (Senapati *et al*. 2002).

In the ultimate analysis, what one is concerned with is all about adaptive management of the given landscape unit as an integrated system with all the natural and human-managed ecosystems, where in the management strategy follows a community participatory bottom-up approach.

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LISU ETHNIC TRADITIONAL CULTURE RESTORATION AND BIODIVERSITY CONSERVATION IN HENGHE VILLAGE IN MT. GAOLIGONG OF YUNNAN PROVINCE

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Introduction

With a total population of more than 1 million in the world, the Lisu ethnic group in China includes 634,912 people, according to the nationwide census conducted in 2005. Most of the Lisu live in concentrated communities in Bijiang, Fugong, Gongshan and Lushui counties of the Nujiang Lisu Autonomous Prefecture in northwestern Yunnan Province. The rest live in scattered communities in Lijiang, Baoshan, Diqing, Dehong, Dali, Chuxiong prefectures or counties in Yunnan Province as well as in Yanyuan, Yanbian and Muli counties in Sichuan Province. Small populations also live in Thailand, Myanmar and India.

Living in the great valleys and mountains through which the Jinshajiang River, Nujiang River, Lantsang and the Irrawaddy flow, the Lisu People developed a glorious and prosperous culture with wisdom and diligence. The earliest recorded literature on the Lisu ethic group is from the Tang Dynasty in which Lisu people were living by hunting and harvesting. The word ‘Lisu’ is recognised in Chinese, meaning people with grain to eat in the Lisu language.

The Lisu people are rich in indigenous knowledge which is widely reflected in their religion, songs and dancing, costumes, festivals, foods, harvest and hunting practices, in their natural calendar, etc. All these traditional cultural manifestations are closely connected with biodiversity conservation. However, with the shock of intrusion of exotic culture, the traditional culture of Lisu is rapidly assimilated, which means most of their traditions are facing a severe challenge to avoid fading away. The present research is aimed at restoring the traditional culture of the Lisu People by exploring the linkage between traditional culture and biodiversity conservation and developing a new series of nature conservation theories.

Research Approach

Background of Research Site

We selected Henghe Village as our research site. Henghe Village is located at the western slope of South Mt. Gaoligong, on the boundary of Mt. Gaoligong National Nature Reserve. This village is attached to Datianpo Administrative Village of Mangbang Town in Tengchong County. The total population of the village is 240 people with 56 households, which includes 200 people (in 46 households) of the Lisu minority, and 40 Han people (comprising 10 households). The community is situated on the mountain side, along the road between Tengchong and Baoshan; electricity and tap water are provided in the villabe. The traditional culture and indigenous knowledge is maintained to some extent in this village.

The Practice of Restoring the Traditional Culture

We adopted a participatory approach in the practice of restoring the traditional culture of Henghe Village. There are 5 study groups organized including a music and dancing group, a costume and culture group, a traditional belief and customs learning group, Lisu Language curriculum development group and biodiversity and traditional knowledge group. The villagers can freely choose the study groups according to their interests and hobbies. Through recovery of the traditional culture, we would like to increase their own identification and confidence, activate the key elements related with biodiversity conservation of the indigenous knowledge, and gradually restore the biodiversity of their living place.

Recovery and Inheritance of Ethnic Music and Dancing: In this group, we invited a senior craftsman specialized in making musical instruments to illustrate basic instrument knowledge and instrument-making procedures. Each participant made three bandores and harmonicas under his guidance. The craftsman also taught them how to play different traditional music instruments and melodies, and systemically taught the 72 major melodies of Lisu ethnic music. The dancing group invited the craftsman to teach songs and dances for different functions, and started to write songs by themselves.

Recovery and Inheritance of Ethnic Costume and Culture: The Costume Group was established by young people who were interested in ethnic costume, and guided by a senior villager who was good at tailoring traditional costumes. Funded by the project, they made 24 sets (12 sets for men, 12 sets for woman) of traditional costumes. During the courses, the teacher also explained the symbols of each costume and its decorative features.

Learning Traditional Religion and Customs: Young villagers grouped voluntarily, learned from senior villagers, and recorded and sorted out the cultural traditions they collected.

Developing Lisu Language Courses: The villager who is well-versed in Lisu language compiled the teaching materials and taught the whole village systematically. The participants are very interested in learning now.

Biodiversity and Traditional Indigenous Knowledge: This group is composed by volunteered villagers who have interests in biodiversity and traditional indigenous knowledge. After training by ethnobotanist and traditional indigenous knowledge experts, the participants started to conduct research on traditional collection, animal hunting, as well as seed collecting and seedling.

Results and Discussion

Lisu people believe in both traditional religion and foreign religion. The nature-oriented traditional religion worship gods related to nature such as sky, mountains, etc. For instance, the Mountain God governs all the animals, plants, rocks, streams, and so on in the mountains. People worship the Mountain God and appreciate his kindness before cutting down trees, collecting wild vegetables and medicinal plants. Totem worshipers believe that their ancestors have marriage relationships with animals or plants, and that they are the offspring of some certain animal or plant. For example, Tiger (Offspring surname Hu, same pronunciation as tiger's Pinying in Chinese), Bamboo (Zhu), Qiao, Ma, Bee (Feng), river deer (Zhang), Vegetable (Cai), Fish (Yu). The foreign religion is mainly Christian, which was introduced in the 19th century and stands in conflict with traditional religion.

Lisu people use the rhythms of the seasons, and of animals or plants in nature, as the basis for dividing their year into a dry season and wet season, with 10 months, including Flower-blossoming Month (March), Bird-Singing Month (April), Mountain-firing Month (May), Hungry Month (June), Plant-Collection Month (September, and October), Wine-boiling Month (November), Hunting Month (December), New-Year-Festival Month (January) and House-building Month (February). This natural calendar is called the phenological calendar or flower-bird calendar.

Plant collection is traditionally very important for the Lisu. There are about 200 plant species which are useful as vegetables, other foods, and edible oils which have collected traditionally. Around 300 kinds of herbs are used by the Lisu people, most of them are sold to folk doctors or druggists while some are used by the collectors themselves. Dozens of wild plants are also collected as food for livestock, sacrifice or bamboo basketwork.

Hunting has a very significant role in the traditional life of Lisu people. About 100 kinds of animals are hunted. The hunting was relative reasonable, with local regulations on the ways of hunting, the tools and time of hunting as well as the taboos of hunting, which helped to maintained the species populations. As hunting prohibition policies are applied, hunting in Lisu Community is gradually fading away.

Lisu people's singing and dancing, and their costumes, are also closely associated with biodiversity, such as the song of looking for vegetables, song of hunting, bird and beast dancing in which the voices of birds, beasts, fishes and insects are shown iconically. There are dances by such names as Crow Drinking, King of Birds, Chicken Digging Food, Fish Dancing, Parrot Pecking the Corn, and Beating the Monkey etc. In all there are about 20 kinds of dances in Bird and Beast Dancing. There is a touching legend associated with the dress of the male Hua Lisu, known as the "magpie" suit, and the style of the female dress is said to have been adapted from the plumage of an elegant and beautiful thrush. Lisu people's traditional songs, dances, and costumes reflect the sustainable

utilization of biodiversity resources. The dances and costumes of Lisu people have been greatly influenced by Han Culture; except a few senior people, most of the young men seldom act in a traditional way.

Conclusions

- The traditional culture of Lisu people is very closely related to nature and it is feasible to link the traditional culture with nature conservation via the restoration of traditional culture. In the practice of nature conservation, how to use traditional culture in ethnic areas at a larger scale is to be further explored;
- The recovery of traditional culture has restored the pride and confidence of these minority people, and awakened public concern about nature. We believe it can be a very effective tool to deliver the biodiversity message to the people of the community;
- In the practice of traditional culture restoration, public understanding of indigenous knowledge has been awakened. However, it has also raised a challenge as to how to effectively protect indigenous knowledge;
- The restoration of the traditional culture of the Lisu people has reflected the adjustment of the culture to current social situations;
- Traditionally, Lisu people collect plants mainly for home use, which poses very little threat to biodiversity conservation. However, during the past ten years, due to the market demands, there have been excessive collection of some plants, especially certain endangered plant species such as *Dendrobium* and other orchids, which has led to a dramatic decrease in their abundance and thus threatened biodiversity. Therefore, conservation and management should focus on the operation of markets for these and other species of conservation concern;
- Cultural diversity and biodiversity is interrelated, and the latter provides the basic environmental context for the former, while the former enhances the biodiversity conservation;
- Foreign religions conflict with traditional culture. In Henghei Village, some of the villagers who believe in Christianity are not allowed to believe in “primitive religion” or even attend any of the community’s own traditional activities, such as singing and dancing. Further, the conflict can not be reconciled and it is exclusive; this should be studied further.

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TRANSFORMATION OF TRADITIONAL FOREST MANAGEMENT IN THE MOUNTAINOUS AREA OF MAINLAND SOUTHEAST ASIA: PAST EXPERIENCES AND LESSONS

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Introduction

This paper aims at providing some experiences and lessons from ethnic communities in the mountainous areas of mainland Southeast Asia (MMSEA). Examples are drawn from the MMSEA member countries, especially those from the uplands of Laos, Thailand, Vietnam as well as Yunnan Province of China. Much of these are based on the results of the United Nation University project on People, Land Management and Environmental Change (PLEC) where the focus was on biodiversity conservation in the village landscapes of countries in humid tropics throughout the world (Brookfield *et. al.* 2003).

The mountainous region of mainland Southeast Asia encompasses Yunnan Province of China, the Kachin and Shan States of Myanmar and the northern region of Thailand, Laos and Vietnam. The area is rich in ethnic diversity with different social and cultural backgrounds in managing tropical and subtropical forests in the sub-region. Within the context of national and trans-boundary watersheds, the area is serving ecological functions of national, regional and global significance. The area has undergone economic boom and bust cycles during the past two decades. However, massive infrastructure development continues under the national sub-regional economic development plans, in particular the Greater Mekong Sub-regional (GMS) economic cooperation initiative assisted by Asian Development Bank (ADB 2000). The mountainous areas in mainland Southeast Asia which were once relatively isolated are now opened to outside influences, creating great challenges for conserving natural forests and biodiversity.

Transformation of Traditional Forest Management

Transformation of forest management systems in the region began much earlier and continue to be affected by rapid and extensive political, economic and ecological changes. These changes are having many consequences, including not only social and economic consequences for the smallholder households but also for the ecology of the environments at various scales from the field to the landscapes and the nation. Although traditional forest management includes numerous forms of land use, much attention is given to shifting agriculture which is one of the dominant and extensive traditional forest management systems in the tribal community (Kunstadter *et. al*. 1978, Rerkasem & Rerkasem 1994). Therefore, the transformation of traditional forest management has been largely focused on the suppression of shifting cultivation and the promotion of alternative land and forest management including production of alternative cash crops. In the case of former opium-poppy growing communities, the periods of transformation from shifting cultivation to alternative cash crops vary greatly, from perhaps >50 years in Yunnan to only 6 years in Vietnam. Local adjustments to alternative land and forest management have been great, regardless of cultural background in traditional management, i.e., pioneer *vs*. rotational shifting cultivation.

In general, increasing infrastructure development, communication and transportation, and the intrusion of external markets have been the major driving forces in transforming traditional forest management systems to a dominant landscape of cash cropping, including intensive annual and perennial as well as plantation crops. The scale of production varies greatly from large scale production of plantation trees and industrial crops (e.g., rubber, tea and sugarcane) in Yunnan to small scale production in Vietnam and Thailand (involving many tropical and sub-tropical fruit trees, vegetables and cut flowers). However, there have been examples of cross-border transfer of production technologies of these perennial cash crops and tree plantations. In the northern provinces of Lao PDR, i.e., Bo Kaew, Luang Nam Tha, Udomxay and Pong Saly, rubber plantation has become

the dominant landscape on the mountains over the past 10 years. Rubber is also a successful alternative crops in the Wa and Kokang territories in the Shan State of Myanmar. Apart from China, national policies in these countries also promote perennial cash crops and tree plantations. One successful example is the spread of teak plantation in Luang Prabang and other nearby provinces, which has been supported by local government for the past >20 years to stabilize shifting cultivation with viable alternatives. In short, the economic development in the region could transform the complex and bio-diverse landscapes of the natural forests into simplified landscapes dominated by large-scale monocultures of tree plantation or agricultural crops.

Such management of simplified ecosystems may lead to severe destruction and degradation of land and forests and increasing marginalization of local forest-dependent communities as the result of rapid agricultural expansion into forest area. Despite many attempts to solve the problems with conservation measures aimed at ending land degradation, forest destruction and unstable agricultural production, success has been highly variable with little understanding where improvement occurs. In contrast to the above picture, smallholder households are managing forests with complex structures and diverse species compositions to ensure food security and sustain their livelihoods, and at the same time to provide ecological services, for example the mulberry paper-based agroforest with incorporation of *Styrax* tree to enrich short fallow and extraction of benzoin in Luang Prabang. The double objectives of conservation and development could be the key to achieving the policy goal of sustainable development at various scales from local to national and regional levels (Stocking 2001). Greater understanding of these traditional systems is required in order to promote sustainable forest management on a large scale in the sub-region.

Farmers' management of forests

A few examples from the highlands of northern Thailand are selected to illustrate farmers' management of forests in the face of change for the past 30 years or so. A Hmong community in Pah Poo Chom village has moved from traditional forest management with opium-poppy based shifting cultivation to intensive agricultural production on permanent basis. The community had almost completely collapsed in the early 1970s after the sudden shift to alternative systems involving permanent agricultural production. Using their customary rules and traditional knowledge, the community as a whole is strictly conserving natural forests in headwater areas. This also helps them to manage intensive production of vegetable with gravity-fed irrigation for external markets. A few farmers also manage agroforest edges between major production plots in this agricultural landscape. One exceptional (expert) farmer has developed these edges much further with a diversity of perennial shrub and tree species of high economic and social value. The overall number of species may exceed 114 species with high diversity indices (Table 1). While most of the trees are used for firewood, many are used for construction and farm tools. Some 16 species are herbs and spices, other 25 species are used as food for household consumption.

Table 1. Biodiversity assessment of forest plots managed as edges in agricultural landscape in Pah Poo Chom village of northern Thailand.

Responsible person for management	Total individuals	Species richness	Shannon index	Margalef index
Expert farmer Saophang	717	114	2.77	17.19
Non-experts (average)	315	38	2.35	6.39
- Juk Saehang	332	33	2.29	5.51
- Jointly managed by Chao and Chang Seng	315	18	1.54	2.96
- Unidentified person	300	62	3.24	10.69

In constrast to Pah Poo Chom, the Karen community in Tee Cha village is one of the few villages in northern Thailand that still practices shifting cultivation but under tremendous pressure to reduce fallow with short cycle for productive natural regeneration of traditional fallow forests. *Macaranga denticulate*, a pioneer tree species, was found to sustain rice productivity and productive regeneration of shorter fallows. Upland rice production after a 7-year fallow period of densely populated *Macaranga*

may give yields of up to 4.5 kg/ha. Aboveground fallow biomass can be as high as 43 t/ha, providing 536, 38 and 253 kg N, P and K per ha respectively. Nutrient recovery is much higher than in other rotational systems reported earlier in other village in the area. One of the reasons behind this productive forest regeneration is the contribution of belowground diversity that is associated with *Macaranga* tree. Some 30 species from 6 genera of arbuscular mycorrhiza fungi in the rhizosphere of *Macaranga* have been isolated so far. The dominance of *Macaranga* does not appear to have any negative effect on the diversity of other tree species. As forest succession proceeds, the abundance of Macaranga declines greatly, from 10,925 trees/ha after two years to 1,653 trees/ha after >7 years of fallow regrowth.

Conclusions

Changes in forest landscape are expected to continue in the sub-region with a mixture of sustainable and unsustainable management. Many smallholder households have the capacity to develop alternative management systems of many different forms and at different scales from the field to the landscape. There is a need to document and analyze these systems for sustainable forest management at national and sub-regional scales. Despite the long history of traditional knowledge, customary rules and regulations, scientific understanding of traditional forest management systems is severely lacking. As a result, replication of good practices in traditional forest management is often found to occur only at a limited scale in specific sites, and opportunities to build on local ideas and initiatives remain limited.

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INDIGENOUS FOREST MANAGEMENT SYSTEMS OF THE IKALAHAN

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The tribal name, Ikalahan, means “People of the Forest”. The forests are more than their habitat. The people and forests are a single ecosystem. About 60,000 Ikalahan live in the Caraballo and Cordillera Mountains of Northern Luzon, Philippines at elevations near 1,000 meters. The climate is cool and the average rainfall is about 4,000 mm/year. In the 14th century the Ikalahan lived by producing taro in small, irrigated, mountain ponds and by hunting, gathering and fishing in the pine, oak and dipterocarp forests.

In the 16th century Chinese merchants introduced rice and Spanish settlers arrived with camote (*Ipomoia batatas).* The latter was better suited to the steep slopes and high elevations and soon supplanted taro as their staple food. Camote were grown in swidden farms in the dipterocarp or oak forests and the farmers could begin harvesting tubers after 3 months and continue a daily harvest for two or more years until a biological indicator, a weed with white blossoms, warned them that it was time to fallow the field. They then encouraged a forest fallow (up to 15 years) that would produce the needed biomass to make enough ash to cancel the acidity so the field could be re-cultivated. To help maintain fertility and protect from erosion they developed *in-situ* contour composting which they called *gengen.* Other technologies were developed over the centuries including an *in-situ* composting technique for the few level lands. They called it *day-og*. Several varieties of camote were planted in each field to ensure harvests against the frequent typhoons. The fields were often belted with countour planting of deep-rooted plants to further protect against erosion, a process they called *balkah.* Fruit for consumption and tiger grass for handicrafts were planted along the edges of the fields.

In 1973 the tribal elders, representing about 2,500 people, incorporated themselves as the Kalahan Educational Foundation to protect their lands and culture while simultaneously providing appropriate education for their youth. They got control of about 15,000 hectares and began processing wild fruit and other resources to add economic value and combat poverty. The communities thus protect the biodiversity and improve the quality of life for both flora and fauna, including humans.

The people still continue to modify their technologies. They now intercrop *Alnus nepalensis* with their camote. This expedites the fallow, reducing the duration from 15 to 7 years. This potentially doubles their available agricultural land. In fact, however, the excess farmland has been transformed into production forests.

The forests have always provided the Ikalahan with adequate lumber and fuel. To obtain lumber they merely culled the needed trees from the forest, being careful not to disturb the forest. Some of the tops, limbs and slabs became their fuel. They have now codified that system into the Forest Improvement Technology (FIT) that can produce 3 times as much lumber as the government logging system without damaging the forests, wildlife or forest services.

The people originally obtained most of their cash from the sale of ginger, a very pungent sub species much in demand. Ginger production is less common now because the plant prefers very rich soil and the people do not want to expand their cultivation into the forests to find such rich soil. The people have been making soft brooms from the tiger grass which grows on the borders on their swidden farms. The price of brooms has not kept up with the cost of living, however, so only a few people are making them now. They still produce the tiger grass and and sell it to lowlanders who make the brooms. To provide both cash and local employment the Ikalahan now do other value adding activities. Primary among them is the processing of wild fruit into high quality jams and jellies. These are sold in the cities under the Mountain Fresh brand. The Forest Improvement Technology (FIT) program will soon be producing so much lumber the people will not be able to use all of it in house construction. They plan to start a small furniture industry as soon as that happens. They also have the skills to make high quality hand-made paper. They did not develop an adequate market several years ago when they developed those skills. It now seems hopeful that a new market is developing. If so, they will begin making paper again. In this way, they keep their educated youth in the area to provide future leadership for the community.

This is still not enough to eliminate poverty in the area. They have documented, however, their Environmental Services and hope that they can eventually capitalize on them. They know how much water they are providing for the huge irrigation system downstream. They should be paid for that service. They have documented the amount of carbon their production forests have sequestered. When they are able to sell that carbon to some of the polluters it will move the communities above the poverty level and provide for educational and medical services for the entire community.

Many people have now learned of the effectiveness of our training program. Visitors have come from many places in the world, including Kunming, to visit our small village in the mountains. Our people can earn some money by training such in ecology and forest management. The Ikalahan now have legal control of about 35,000 hectares of their ancestral domain where they can maintain and expand their ancient agricultural and other technologies.

WITH OUR OWN HANDS: BAREFOOT TRAINERS, LOCAL KNOWLEDGE AND SUSTAINABLE LIVELIHOODS AMONG THE HIGAONON TRIBAL COMMUNITIES IN THE PHILIPPINES

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Introduction

Increasing dwarf landholdings, mainly due to population pressure, inroads of commercialism, adoption of "modern agriculture," government neglect and incapacity, unabated small-scale logging, among others has reduced the Higaonon tribal communities as well as other tribes and upland farmers in Mindanao to paupers in their own lands. They are unknown and uncared for, smothered by the practices and mores of western influences, their upland resource-base decimated and heavily eroded. Much of the biodiversity is being lost without the outside world or even the Higaonon knowing of the existence or potential usefulness of these resource. Natures' services of their upland resource such as carbon sequestration, biodiversity, pollination and water retention are never considered and misunderstood.

Methodology

This paper presents the result of a process-documentation and upland development initiative of the Local Empowerment Foundation (LEF) spanning a period of 5 years. The projects' goals are to promote and revive traditional forest-related knowledge, promote sustainable livelihoods and mobilize indigenous leaders as barefoot trainers and champions. The project is being funded by the German Doctors for Developing Countries (Germany) and the Broederlijk Delen (Belgium). Data gathering involved participant-observation, reviews of reports of community facilitators and technicians and in-depth interviews with barefoot technicians and local farmers. Analysis of the data is mainly descriptive and case study-type.

Results and Discussion

In terms of promoting local knowledge, we found out that local farmers are effective in disseminating knowledge regarding farm and forest development when trained as barefoot technicians. Most training is not the usual paper and pencil-type but mostly on-site practicum in their own fields, as 'learning by doing' has been found to be appropriate and effective. Visits to demonstration sites located in the cities like Davao and Cagayan de Oro are kept to a minimum and always with a caveat that the technologies there may be inapplicable in their own situation. Training topics include importance of biodiversity, raising and planting of trees with focus on ASEAN's most important trees, soil and water conservation, development of local livelihoods, human values, promotion of indigenous culture and local leadership.

The barefoot technicians grow with their land and are proud of it. Their compensation is economic and psychological, consisting of recognition, awards and certificates and they are prioritized to receive farm inputs for their agro-forestry farms comprising small and large animals (goats, pigs, cows, water buffaloes), tree seedlings and vegetable seeds. These inputs they will have to pay as low-interest bearing loan and plowed-back into their local associations as revolving fund. The average revolving fund per association is 55,000 pesos (1,250 USD). The barefoot technicians are tasked to train their neighbors, usually 5-7 families, and the most progressive are in turn invited to become barefoot technicians. To date we have 160 full-pledged barefoot technicians (having started with 40) serving 12 barrios in Misamis Oriental.

We are closely linked with technicians from the provincial and municipal governments but our experience in this aspect has been bleak, as the technicians' knowledge-base is outdated. Their knowledge mostly pertains to high-technology plantation-type agriculture and forestry. The possibility of marrying indigenous knowledge is never considered. The government technicians are also saddled

with heavy administrative concerns and severely restricted in conducting fieldwork because of lack of budgets.

The Higaonon cultural heritage and values are being inundated by outside influences and the young generation is ashamed about their cultural heritage and even hide their identities, making sure that they speak in Cebuano and not the traditional Higaonon language. Dances, rituals, chants and indigenous knowledge in general are degraded in this way. But one thing we found out though our work is that age-old animism, rituals, magic and beliefs are not really lost and they are intertwined in their day to day living. Sacred groves and burial places are where their ancestors live and intimate knowledge of plants and animals are retained. There are plants that are used to cure ailments and in times of famine such as during El Nino years, they gather certain tubers, which wash these overnight in running water and consumed as food. Some ailments of their animals, especially water buffalo which is important for them as it helps them in farming and in carrying heavy loads, are treated with herbal concoctions. The forest is a source of their daily sustenance and livelihood. The main products that they gather and sell to lowlanders are fruits, bananas, mushrooms, ferns, orchids, rattan, creepers, baskets, nuts and honey. Prices of these products are low and dictated by traders, who either go up the mountains to buy from farmers or else purchase these products from farmers when they go down from the mountains on weekly market days.

The problems that the Higaonon are encountering include: constant intentional or natural fires which occur frequently during the summer, decimating what is left of their forest resources; unmitigated small scale logging due to the lack of timber to build houses and for other uses, so that even young trees are already being cut; lack of appreciation regarding the importance of their forest resources; and population pressure. Population pressure is the most difficult to deal with, given their idea that children are gifts from God, security during old age and that children are resource that can help them in doing back-breaking chores. There is also the problem of overlap between customary laws and the laws of the Philippine government especially as they relate to tenure rights and land boundaries. Leadership among the tribal leaders is also problematic, especially amidst the lure and pressures of logging and mining concerns and poverty.

Even with these problems, there are a plethora of opportunities that the Higaonon communities can or are already pursuing in order to improve their lives. These include: promoting local plants as herbal medicines in tandem with low-impact eco-tourism, and in popularizing superior varieties of ASEAN's most important trees such as rambutan (*Nephelium lappaceum*), mangosteen (*Garcinia mangostana*), lanzones (*Lansium domesticum*), santol (*Sandoricum koetjape*), tamarind (*Tamarindus indica*), mango (*Mangifera indica*) and noni (*Morinda citrifolia*), species renowned for their high food value and medicinal properties. They also plan to participate in the arena of "green development," collaborate with bio-labs, research networks and commercial ventures worldwide, using the land, human resource and traditional knowledge system as capital.

Long-term plan that they want to pursue include: establishing a "living museum" wherein their forest and upland resource will serve as the main resource, and indexing, propagating and marketing seedlings of ASEAN's most important trees in Mindanao. This is with the realization that seedlings are of inferior quality because they are propagated from unexamined trees. The concept of the living museum is different from the traditional herbarium, enclosed type but will feature not only the forest resource but also their living culture and way of life. A 6-hectare land area is now being readied for this initiative. They are starting to look at how they are able to produce and market products from plants for the local market and later on to seek commercial partners from outside. For example banaba (*Lagerstroemia speciosa*) grows wild in the area and is said to be high in corosolic acid which is a natural plant insulin and useful in lowering blood sugar. Cough remedies derived from plants are already marketed locally with some success. Treatment of intestinal parasites of farm animals using leaves of local plants is also practiced.

In the arena of advocacy, there is a growing realization among local leaders that they should actively participate in international governance dynamics so that they will not be smothered forever. The value of the internet enhances communication networks with other tribal communities and support system worldwide and in market promotions of products, services and technologies. The latest declaration on forests and climate change (Sydney) are windows of opportunity windows. But firstly they have to realize the need to be organized in order to have a voice and to have a recognized articulator of their interests. Their initiative in this respect is to use their neighborhood interest groups and associations as a springboard to create a local federation. Thus a local federation was born and composed of 58 local groups. It is governed by a board composed of elected leaders from the local groups and managed by a committee holding office at the LEF since that they cannot yet stand on

their own financially. Organizational strengthening in the arena of financial management, conflict management, leadership and organizational management is on-going with trainers and experts sourced from the local academe, NGO and local government units. They are planning to link and network with like-minded organizations in the Mindanao area and possibly nationally.

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KNOWLEDGE OF WILD PLANTS FOR HUMAN AND VETERINARY USE IN WEST BENGAL

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Introduction

It has been observed that the tribal populations living in remote forest area are in good health in comparison to the tribal population living in deforested areas. Forest-based tribal community members seldom suffers from contagious diseases like skin infection, or from hypertension, diabetes and non-viral respiratory infections. The reason is that tribal groups living in remote forest area use roots, tubers, fruits and some other forest based dietary nutritional food supplements that provide their balanced nutritional requirements (Singh *ca*. 2004) and thereby decrease their susceptibility to these health problems.

In the current work, the author has tried to bring together the knowledge of the local people and knowledge of Ayuerveda regarding 12 plants found in West Bengal in India. The use of these plants in preparation of herbal medicines is also highlighted along with ongoing research in allopathic medicine. This paper is part of an ongoing research on local/traditional knowledge in health and healing (Sen 2007).

Objectives and Methodology

The objectives of the study were to:

- Develop a listing of the traditional medicinal plants used by local people of selected areas of West Bengal for common ailments;
- Record the use of plants for veterinary problems;
- Review the status of these plants *vis-a-vis* their uses in Ayurvedic, herbal and allopathic medicine.

Interviews were conducted in local communities to investigate the knowledge of the local people who are the main users of medicinal plants. The data on plant species were recorded during field trips. All the plants described are found in the wild.

Plants and their local uses

Abrus precatorius L.

Family: Fabaceae (Papilionoideae). Bengali name: Kunch.
Veterinary use: For acute colic (root); ephemeral fever (root); skin allergy (leaves, root).
Human use: *Stomach ache*: 10-15 drops of leaf extract with half cup water. Apply paste of leaf on stomach to cure stomach ache.
Skin eruptions: Fruit paste (one part e.g. 10 gms.) cooked in 10 parts (100 gms.) sesame (til) oil. Oil to be strained and applied

Abutilon indicum (L.) Sweet

Family: Malvaceae. Bengali name: Petari
Veterinary use: For ephemeral fever (root).
Human use: *Cough*: Seed powder a large pinch. 2 to 3 times a day with honey.
Tooth ache and pain in the gums: Gargle with water in which leaves have been boiled.
Boil or bruise: wash with water in which leaves have been boiled. Then apply a paste of leaves or flowers.

Achyranthus aspera L.

Family: Amaranthaceae. Bengali name: Apang
Veterinary use: For maggot wounds (root).
Human use: *Loss of appetite/problem with digestion*: Root 1/8 portion with black pepper 7/8 portion ground, made into small pills and dried. To be taken twice after food.
For potbelly: green plant wrapped in banana leaf, tied with green creeper coated with mud, roasted on fire. Juice extracted from the roasted plant. Two tea spoon drunk with 7/8 tea spoon of water. With some diet restriction this will give result in a month.

Adina cordifolia Willd. ex Roxb.

Family: Rubiaceae. Bengali name: Kadam
Veterinary use: Stem and bark used for acute colic, diarrhoea, fracture.
Human use: *For bad breath or odour in the mouth*: Cut flowers into pieces, boil in water. Use the water for gargling.
Deworming: Leaf juice to be drunk

Albizzia lebbeck (L.) Benth.

Family Fabaceae (Mimosoideae). Bengali name: Shirish
Veterinary use: For eye injury (tender leaves); skin allergy (leaves).
Human use: *Strengthening teeth and gums*: Brushing teeth with powder of root bark.
Migraine: A very small pinch of bark of the root or seed powder to be taken as snuff but not more than twice a day.

Alternanthera sessilis R. Br.

Family: Amaranthaceae. Bengali name: Burmashak
Veterinary use: Used as fodder. It gives strength
Human use: *Deworming*: Two tea spoons of the juice with equal amount of water drunk warm.
Excretion of saliva from mouth during sleep: One to one and a half tea spoon of juice with 3 to 4 tea spoon water drunk warm.

Anogeissus latifolia (Roxb. ex DC.) Wall.

Family: Combretaceae. Bengali name: Dhava
Veterinary use: For cough and cold, (stem bark); diarrhoea, (stem bark)
Human use: *Anemia:* Fresh stem skin juice 2 tea spoons daily. If fresh stem is not available bark powder boiled in water 3 to 4 tea spoon twice a day.
Piles: Both fresh juice and bark extract are beneficial

Argemone mexicana L.

Family: Papaveraceae. Bengali name: Shialkanta
Veterinary use: For black quarter (root); haemorrhagic septicaemia (root, whole plant); ticks (seeds).
Human use: *Skin eruptions*: Boil seeds with mustard oil, apply.
Sting of wasp: Immediate application of root paste reduce burning sensation

Aristolochia indica L.

Family: Aristolochiaceae. Bengali name: Ishermul
All species of Aristolochia are considered to be endangered in India
Veterinary use: For diarrhoea (root bark) haemorrhagic septicaemia (root bark).
Human use: *Stomach ache:* One cup Root powder with little warm water. Asthma Root powder ½ cup. With a little water gives relief but does not cure.

Asparagus racemosus Willd.

Family: Liliaceae. Bengali name: Shatamuli
Currently considered to be vulnerable due to over exploitation in India
Veterinary use: For increasing milk yield (root).
Human use: *Breast milk drying up:* Juice of root 2 tea spoon, half cup milk and 1 tea spoon sugar taken twice. Will start lactating after 3 to 4 days.
Biliary colic: Root juice 2 to 3 tea spoon with a little (1/2 cup) raw milk to be taken on empty stomach. However food has to be controlled.
Blood dysentery: Juice of root 4 tea spoon with 7 to 8 tea spoon milk morning and evening for few days.

Asteracantha longifolia Nees

Family: Acanthaceae. Bengali name: Kulekhara
Veterinary use: For dysentery (seeds).
Human use: Anemia: Leaf juice warmed 4tea spoon twice a day. Stops bleeding from cuts leaf pulp to be applied. The wound also dries fast. Insomnia: Root juice 2 to 4 tea spoon taken in the evening.

Azadirachta indica A. Juss

Family: Meliaceae. Bengali name: Neem
Veterinary use: For diarrhoea (stem bark); maggot wound (seed oil); lice (leaves); worms (stem bark)
Human use: *Jaundice:* 25 to 30 drops of leaf extract with a little honey to be taken in the morning on empty stomach. *Blood sugar*: 10 leaves with 5 black pepper to be chewed on empty stomach. Diet has to be controlled *Deworming for children*:. Pinch of leaf powder to be taken with water on empty stomach.

Conclusion

The 12 plants were checked against the list of plants used in the Ayurveda, Unani and Siddha systems of traditional Indian medicine as provided by the Central Herbo Agro Marketing Federation of India. It was found that 10 of the plants on this list. There is ongoing research in allopathic medicine as reported in Pub Med. On analysis, it was found that herbal health care companies in India were utilizing 6 of the 12 plants. These plants are *Abutilon indicum* (L.) Sweet, *Achyranthes asper* L., *Albizzia lebbeck* Benth., *Alternanthera sessilis* R. Br., *Asparagus racemosus* Willd., *Azadirachta indica* A. Juss. According to a survey done by Singh (ca 2004) the number of pharmaceutical companies using different parts of medicinal plants was 373.

That local population is knowledgeable about medicinal plants and these for them are cheap source of treatment and cure is reinforced. WHO has shown its concern regarding misappropriation of natural resources, preservation of biodiversity and protection of medicinal plant resources for the sustainable development of traditional medicine.

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EVALUATION OF A PARTICIPATORY MONITORING SYSTEM FOR NON-TIMBER FOREST PRODUCTS: THE CASE OF AMLA (*PHYLLANTHUS SPP.*) FRUIT HARVEST BY THE SOLIGA IN SOUTH INDIA

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Introduction

The dependence of local communities on non-timber forest products (NTFP) led to a proposition that enhancing incomes from sustainable NTFP harvest can help maintain local livelihoods as well as provide local communities economic incentives to conserve biodiversity (e.g. Nepstad & Schwartzman 1992). An enterprise approach to conservation operates on the belief that greater economic returns can provide incentives for self-regulating harvest levels, and thus for conservation.

A key feature of a successful enterprise approach to NTFP conservation is a sound monitoring and evaluation program that involves local harvesters and communities. In this paper we discuss our experiences using a participatory research model that we developed and employed over a ten year period (1995-2005) for the wild-harvesting of NTFPs from the Biligiri Rangaswamy Temple Wildlife Sanctuary, South India. Around 6000 Soligas are an indigenous tribal community who live in the Sanctuary. Although our work has encompassed a range of NTFP, here we report specifically on the participatory monitoring efforts for two NTFP species harvested for their medicinal fruits: *Phyllanthus emblica* Linn and *Phyllanthus indofischeri* Bennet. (Euphorbiaceae) both known locally as *amla* or *nelli*, or as Indian gooseberry in English. Both are medium-sized trees found in dry deciduous and scrub forests. Their fruits are rich in vitamin C and are widely used in pickles, jams, preserves, jellies and Ayurvedic medicines. The Soligas retained the sole right to NTFP extraction under the aegis of a tribal cooperative called the Large-Scale Adivasi Multi-Purpose Society (LAMPS). Recently these rights have been nullified and ban was imposed on harvest.

The objectives of our paper are to: 1) Describe the establishment and evolution of our participatory resource monitoring (PRM) activities; 2) Compare some of the results of participatory monitoring to those obtained from monitoring using standard ecological approaches; and 3) Evaluate some of the successes and challenges associated with our PRM model.

Methodology

In 1995, in collaboration with the local non governmental organisation called Vivekananda Girijana Kalyana Kendra (VGKK), we initiated activities to set up an enterprise to increase the Soliga's income from NTFP harvest. The core idea was to increase the Soliga's economic stake in the sanctuary's biotic resources by generating additional income through processing NTFPs on site and marketing them directly, so as to capture a greater share of the final value. Over the years, we initiated the following activities to strengthen the Soliga's capacity to monitor and protect NTFP.

Pre-harvest meetings were initiated and held 4-5 meetings during the amla fruiting season in each settlement (*podu*) per year. During these meetings we discussed harvesting methods and emphasized the importance of certain conservation measures such as leaving a proportion of fruits on the tree for regeneration, removing hemiparasites, and not lopping branches while harvesting fruit. Hemiparasites significantly increase amla mortality and reduce fruit production, and branch-cutting significantly decreases fruit production in the following years (Setty 2004).

In 1998 amla harvesters from different settlements visually estimated the amount of amla fruits. The harvesters then drew a map with charcoal on the ground for their estimates. These resource survey maps proved to be particularly useful in turn allowed them to find a good trader to whom to sell their

fruits. The maps also allowed harvesters to identify areas from which they should avoid harvesting if they felt that those areas have been repeatedly over-harvested in the past.

Once the amla harvest season began, rates and quantities of fruits extracted were estimated using three different methods. The first method involved estimates made at the level of individual trees to create awareness in post harvest meetings on better harvest techniques. The second method involved a visual estimation of amla extraction rates at the forest level. The same harvesters who prepared the amla fruit productivity estimation maps for their respective sites and years, also visually estimated the quantity of fruits extracted. Extraction levels were then marked on those same maps. The third method, carried out based on the actual amount of fruits sold by the LAMPS each year. We used this method to cross-check the information obtained from the previous method.

During the harvest season, the summarized the fruit extraction monitoring data were shared with the harvesters to improve the method of harvest for the next day. The objectives of these meetings were to review the harvest both in terms of the amount of fruits harvested and the harvest techniques used, and assess reactions to the participatory resource monitoring. The PRM method of monitoring regeneration was initiated once a year during December or January by the community. Every year, a team of 10-15 harvesters estimated regeneration of amla in the forests by counting the seedlings, saplings and adult stems of amla with three to four plots of $20m^2$.

Comparison of PRM and scientific estimates: To assess the effectiveness of the PRM visual monitoring of fruit production levels, we established an independent, systematic estimate of fruit production. For this, ten 1000 x 10 m transects were established randomly. The visual estimates of amla fruit production made by the harvesters were very similar to those obtained using the scientific transect methods.

Results and Discussion

Since 1996 a total of 175 pre-harvest meetings and 126 post-harvest meetings were carried out. The total attendance was 8626 including men, women and children. Significantly lower levels of branch cutting were recoded in the high-PRM site versus low ($\chi^2 = 34.95$; $p < 0.0001$). Since branch-cutting leads to significant decreases in fruit productivity (Setty 2004), this reduced branch cutting can be expected to lead to greater productivity. The proportion of fruits harvested was also lower in the high PRM site than low, while the reverse was true for the proportion of trees with hemiparasites removed. Our data also illustrates a strong negative correlation between the percent of trees that had branches lopped and the number of post-harvest meetings ($r^2 = 0.93$). Sharing of results on harvest levels and practices with harvesters during the post harvest meetings was likely successful in generating more awareness about prudent harvest methods.

The PRM techniques used here provide insight on sustainability in several ways. First, they provide estimates of harvest rates. Second, PRM provides insight on sustainability through the monitoring of regeneration. The success of the mapping exercise coincides with other research which has demonstrated participatory mapping can be an effective tool in resource management (Lynam *et al*. 2007). Similarly there are obvious direct benefits to harvesters who use better harvesting techniques, and there was good participation in reducing the cutting of main branches. In contrast, changes in extraction rates can impact future productivity and harvest levels. There was no interest in monitoring regeneration without compensation for time and effort. A portion of the revenue gained by LAMPS is set aside each year to pay for the regeneration monitoring, so that it is a permanent and long-term feature of the PRM. In 2004 the Indian Forest Department banned NTFP collection for sale. This has placed harvesting and monitoring on hold. However “scheduled tribes and other traditional forest dwellers Act”, passed in December 2006, promises to change this situation.

Conclusion

Our efforts over the past ten years illustrate some PRM techniques that have proved to be highly effective and accurate, including strategies for participatory resource mapping, visual productivity estimation, and discussion and promotion of improved harvest techniques. These techniques provide insight for PRM strategies elsewhere, where they can be adapted and tested. Participatory visual estimates of fruit production were accurate. Pre-harvest and post-harvest meetings provided mechanisms for regulating harvest level by increasing awareness and discussion of current levels of fruit production, extraction, harvest patterns and regeneration. In addition, the enterprise unit,

community institutions and LAMPS also stipulate conservation. Developing these techniques would only be possible where harvesters have tenure over their resources.

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STRENGTHENING THE AETA-MAGANTSI ECOLOGICAL VALUES FOR SUSTAINABLE DEVELOPMENT

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Introduction

The indigenous peoples maintain a concept of sustainable development which is anchored in their indigenous ecological values. However, these values are sometimes altered as circumstances (such as natural calamities, forcible evictions from ancestral lands, acculturation, depletion of forest resources, extreme poverty, growing populations, etc.) arise within their communities. In some instances, these ecological values are maintained by the indigenous people, but are ineffectual due to social or cultural biases of the mainstream society.

According to Berkes (1999), indigenous ecological knowledge not only includes cultural preservation, but also embraces issues such as worldviews, cultural survival, ownership of knowledge or intellectual property rights, empowerment, local control of land and resources, cultural revitalization, and self-determination. Eder (as cited in Ploeg & Masipiquena 2005), however, explains that the traditional systems of resource use, the beliefs about sacred places and sacred resources do not explicitly address possible future resource depletion, rather it serves as a guide towards more sustainable resource management.

The eruption of Mount Pinatubo in 1990 prompted the relocation of the Aeta tribe in the three provinces of Central Luzon – Zambales, Pampanga and Tarlac. To them, Mount Pinatubo was the sanctuary of their supreme god, Apo Namallari. They believe that the animals and trees of the earth are embodiments of the spirits of their departed forefathers (ABS-CBN Broadcasting Corporation 1996), and that these spirits were thriving in their sacred mountain. These beliefs greatly influenced the way they view and deal with nature.

At present, there are about 60 Aeta-Magantsi families inhabiting the Dueg Resettlement Area (NCIP 2000), a relocation site situated in the Western part of the Tarlac Province. As part of the relocation scheme, various projects were implemented by the government sector and non-government organizations in order to ensure their economic survival.

This study was conducted in order to determine the impact of the eruption of Mount Pinatubo on the ecological values of the displaced Aeta-Magantsi, a sub-group of the Aeta tribe. It also aims to determine if relocation and other development programs implemented by the government agencies and non-government organizations helped in strengthening their ecological values.

Methodology

This study focuses on identifying, reviving and strengthening the Aeta-Magantsi's ecological values as a guide for implementing sound and sustainable development initiatives (see Figure 1 for Conceptual Framework). This indigenous group maintains a concept of sustainable development which is translated through the conduct of their rituals and relationship with nature. However, in spite of the established set of ecological values, some factors arise in their community which later compels them to either maintain or completely alter these traditional ecological practices.

In order to strengthen these indigenous ecological values and to utilize them for devising sustainable development programs in their community, these programs require a shared effort and strong support and strong partnership between the external actors, which include the Local Government Unit (LGU), the non-governmental organizations (NGOs), the National Government, and the internal actors, i.e., the indigenous people themselves. Once their ecological values are determined, this will lead to the revival and strengthening of their own notion of sustainable development which could be a basis for future development projects which will be complementary to their values and ecologically beneficial.

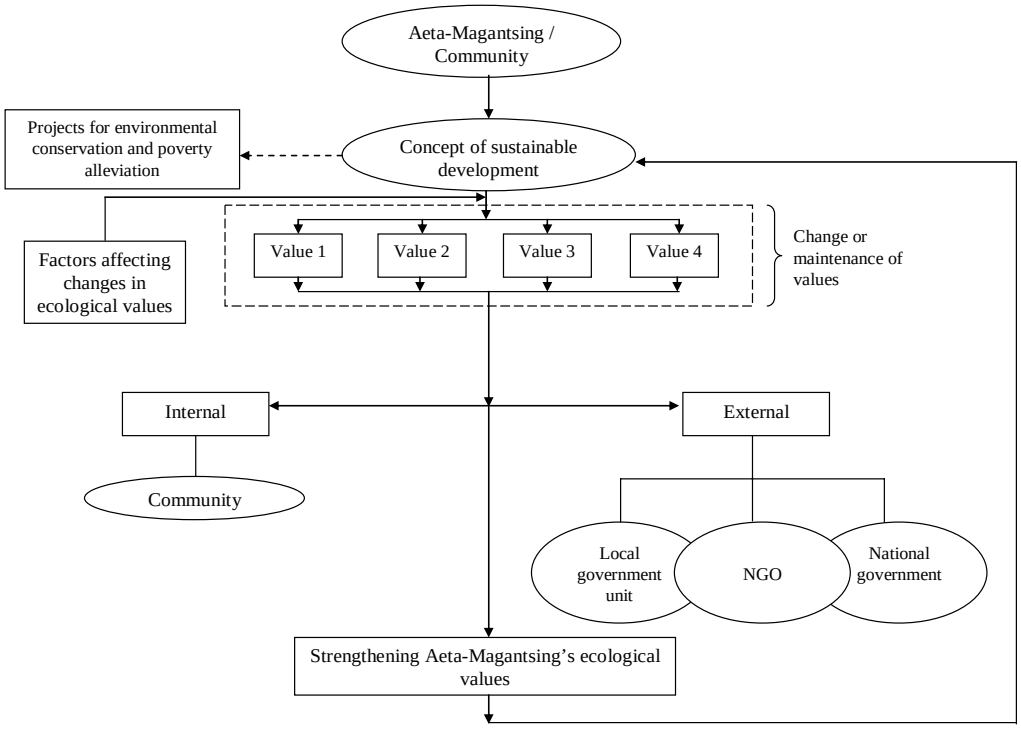

Figure 1. Conceptual Framework

Qualitative research methods were used to identify the indigenous ecological practices and explore the impacts of the relocation program on the ecological knowledge and cultural practices of the Aeta-Magantsi. Specifically, ethnographic study, purposive sampling, on-site informal observation, and triangulation method of Merriam (2002) were employed. In addition, interviews, on-site immersion, and documentary review were used as primary method for data collection.

There were 50 respondents for this study, with individuals grouped according to: (1) age: 20-49 years old (78%), and 50 years old and above (22%); and (2) gender: Male (30%) and Female (70%). Representatives from non-government and government agencies who have experiences working with this tribe were also included as respondents.

Results and Discussion

One of the traditional livelihood practices of the Aeta-Magantsi involved shifting cultivation which was confined to a specific area and would be carried out if the spirits dwelling in that particular area were properly acknowledged. This belief restrains the tribe from engaging in excessive consumption of forest resources, thereby allowing the ecological restoration of the depleted forest reserve.

The respondents agreed that life on Mount Pinatubo was far better than their present situation in the resettlement area and that relocation greatly affected their ecological practices. Likewise, all of them are aware that forest resource are rapidly declining and are willing to help restore the natural equilibrium despite the lack of support from the government sector.

The respondents whose ages are from 50 years old and above believe that trees, animals, and pools are like human beings and that they must be respected and treated properly. They emphasized the importance of offering food before engaging into any activity that will require the cutting of trees. This is done in order to appease the spirits dwelling in the trees. As reflected in their traditional practice of shifting cultivation, they also believe that any source of subsistence involving nature must be protected and consumed judiciously by the entire tribe. On the other hand, members of the tribe between 20 and 49 years old do not engage in any traditional tribal practices; in their view, these were done only in the early days and are no longer applicable at present due to extreme poverty and scarcity of forest

resources. In contrast to the traditional practice of communal ownership, this group prefers individual ownership as a way to improve their economic status. Their preference for this practice started when a communal reforestation project was introduced in the community by the government sector.

The constant pressure from the lowland people, coupled with the economic hardship, compels male members to abandon the practice of food offering or any tribal rituals prior to cutting of trees or clearing of areas for agricultural purposes. The female members, on the other hand, are still aware of the importance of tribal rituals, specifically food offering, but are restrained from doing so because of extreme poverty and scarcity of resources.

The support that the Aeta-Magantsi are receiving from the government and non-government sector remains weak and insufficient since it fails to alleviate their economic condition and uphold their cultural rights. The lack of strong partnership and failure to determine and incorporate the good ecological practices of the Aeta-Magantsi keeps them in a very disadvantaged condition. Therefore, it is strongly recommended that the traditional ecological values of the indigenous peoples be considered and included in devising future development projects.

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LESSONS AND CHALLENGES FROM COMMUNITY-BASED FOREST MANAGEMENT IN INDONESIA

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Introduction

Forest certification schemes involve the awarding of forest management certificates and Chain of Custody certificates (Scheyvens 2006). The certification is expected to be one of the most effective means of verifying the legality of timber and wood products to address the situation that much of the world's forest coverage has been lost due to human interventions (FAO 2005). Forest certification was launched as the realization of global actions to halt deforestation, ultimately towards achieving the Millennium Development Goals, and Forest Stewardship Council (FSC) was established as a leading scheme in 1993. To date, however, these forest certification schemes have had mixed results. The development of forest certification was originally driven with an aim of conserving tropical forests worldwide, but many of the forests that have achieved certification status have been in developed countries (Ozinga 2004, Cashore *et al*. 2006). Also, several types of forest certification scheme besides FSC have launched around the world. Yet, there have been few case studies on their implementation, challenges and impact in developing countries.

With the growing potentialities and respect of traditional knowledge and customary practices for forest management, community-based forest management (CBFM) has been advocated in the mainstream of forest conservation and sustaining livelihoods of local communities. CBFM supports sustainable management and use of forest resources by providing local communities with multiple values, which makes it a critical approach to sustainable forest management. This paper presents a case study of CBFM-certified Indonesian villages: how community-based forest management has been practiced with the multifaceted challenges of the community, linked with a forest certification scheme under the umbrella of sustainable forest management.

This paper has two goals. The first is to examine local perspectives on their community forest management and analyze challenges of their practices linked with the forest certification scheme. The second is, based on the local view and challenges, to propose actions for the international community to support sustainable forest management. This case study addresses the certification of Indonesian Ecolabelling Institute (LEI), a leading forest certification institute in Indonesia. Since this was the first village-based forest management case that was granted the forest certification in the country, the finding of this study can be shared to provide a model for other communities that seek forest certification and promote sustainable forest management. Today, sustainable forest management encompasses a diverse range of forest management approaches. In this paper, sustainable forest management means that local forests are reserved and well-managed for local use and timber production meets demands from outside the village in a way that balances economic growth and forest conservation.

Methodology

Wonogiri District, adjacent to Yogyakarta District in Central Java, is known for its dry and barren areas and its recurrent water shortages. Java's longest river, the Bengawan Solo whose source is located at Giriwoyo in Wonogiri periodically floods during the rainy season (Gondowarsito 1990, *personal communication* 2007). Thus, water management is a serious concern while agriculture is the primary livelihood.

The villages of Sumberejo and Selopuro in Wonogiri were the first villages in Indonesia to be granted LEI forest certification in 2004 (LEI 2005). These two villages are dominated by rocky land, but dotted with teak and mahogany forests. This research analyzes the Sumberejo's attempts to maintain its community-based forest management practice and a traditional philosophy of forest management.

The field information was collected through rapid rural appraisal, interviews and focus group discussions in 2006 and 2007. Among rapid rural appraisal tools, each group used participatory mapping, a seasonal calendar, a historical matrix focusing on ecological changes, and venn diagrams to discuss a specific theme. Also, the informants were asked how forest certification process was introduced by outsiders, nongovernmental organizations (NGOs), and governments into the villages. These opinions would help us understand the reasons for and against the integration of forest certification into local forest management and to see how the certification system would promote sustainable forest management.

Results and Discussion

This section explores the potential and challenges of forest management and also discusses unresolved issues requiring further provisions in terms of compatibility of community-based forest management and gaining economic benefits from their current practice.

Experience and Roads to Forest Certification

Wonogiri ("mountain forest") is one of Central Java's poorest districts. Agriculture, the primary livelihood, alone cannot provide a sufficient livelihood in this chronically dry region, and agroforestry and livestock farming are a safety net for rural livelihood. In the villages, community forestry management has been practiced with their own community rules. The villagers themselves set the following rules before applying for the forest certification: planting ten to 25 trees is obligatory whenever a single tree is cut down; the smallest tree that could be harvested should have a 25-centimeter diameter at breast height (dbh). Consequently, not only does the village enjoy the honor of primary production of teak and mahogany, but the increased water security has also provided the region with more streams and natural fountains where there had been floods and a shortage of clean water during the dry season.

The implementation of sustainable forest management in local areas in transition is a serious concern. This is not to say that forest conservation and sustainable forest management are new to the village. Rather, the local people of Sumberejo have a long tradition of sustainable forest management. In Wonogiri, the concept of *karang kitri* requires people who live on the land to keep it green. When the Association of Social and Economic Studies and Development (PERSEPSI), a development NGO in Java, broached the idea of applying to the villages in 2001, the villagers were not interested because they did not understand the linkage between their forests and forest certification. Some villagers were worried about the expense and the complicated application process. However, they did realize the importance of sustainable forest management from their experience because it was an element of *karang kitri* and could contribute to improve their livelihood. The community began preparing their application with support from PERSEPSI and the World Wide Fund for Nature Indonesia. Finally, CBFM certification was granted to the villages of Sumberejo and Selopuro in October 2004.

Lessons and Challenges

The author examined the difficulty of reconciling villagers' needs for a sustainable livelihood with the demands of community-based forest management and economic growth. The identification of these challenges will help local stakeholders to create a comprehensive plan of strategies and actions for improvements in rural life and sustainable forest management. Also, this research studied local perspectives on the links between community-based forest management and the forest certification, and used those views as the basis of suggestions and recommendations for developing the certification scheme and community-based forest management. Global consumers have influenced the activities and recognition of suppliers and producers as the transboundary transaction of timber resources has accelerated in the world. Therefore, this paper concludes by proposing what the international community and consumers can do to contribute ultimately to sustainable forest management of timber-producing countries. This presentation will allow participants to share a good practice and lessons on sustainable forest management on the ground and discuss what cooperation and support is to be provided in the future.

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CHANGING ROLE OF FORESTRY IN SUSTAINING LIVELIHOODS AND ENVIRONMENT, AND UTILIZATION OF ITK IN FOREST MANAGEMENT

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Introduction

Forests are the most extensive vegetation type on earth and harbor most of the world's terrestrial biodiversity. Forests affect the lives of people everywhere, especially those who are poor and dependent, or semi-subsistent, on forests for food, wood and non-wood forest products, and ecological services that they provide. Large forest areas are the traditional homes of local and indigenous communities. They manage their forests independently, or sometimes in collaboration with government agencies. With greater public interest and involvement in forest management decision-making, there is a growing need for decision-makers and managers to consider all relevant knowledge about forest ecosystems and the impact of forest management options in the development of forest policies and operational practices.

Traditional Forest-Related Knowledge

Traditional forest-related knowledge is defined as "a cumulative body of knowledge, practice and belief, handed down through generations by cultural transmission and evolving by adaptive processes, about the relationship between living beings (including humans) with one another and with their forest environment" (Berkes *et al*. 2002). Traditional Knowledge is a combination of ancient ingenious practices and techniques, locally adapted and distinctive to a territory or a community. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, forestry and environmental management in general (www.cbd.int).

TFRK – The International Scenario

Convention on Biological Diversity (CBD)

CBD Article 8(j) emphasizes "the need to respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles for the conservation and sustainable use of biological diversity and [promotion of] their wider application with the approval and involvement of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices." (CBD: http://www.cbd.int).

UN Convention to Combat Desertification

UN Convention to Combat Desertification (1994) requires parties to "…protect, integrate, enhance and validate traditional and local knowledge, know-how and practices" and that "…owners of that knowledge will directly benefit on an equitable basis and on mutually agreed terms" (CCD, Article 18[a]; http:// www.mcpfe.org).

Intergovernmental Panel on Forests

The report of the special Intergovernmental Panel on Forests (IPF), presented to the Commission for Sustainable Development (UNCSD, 1997) and identified following priority research areas on TFRK**:**

- To recognize and support traditional resource use systems incorporating TFRK
- To explore the relationships between TFRK and sustainable forest management, and establish stronger linkages between traditional and emerging national sustainable forest management systems

- To recognize TFRK in developing national criteria and indicators for the sustainable management of forests within the context of national forest programmes
- To identify ways and means to secure the effective protection of indigenous rights and the fair and equitable sharing of benefits arising from the use of TFRK

World Forestry Congress

The XI World Forestry Congress, convened at Antalya, Turkey (WFC 1997) also highlighted the importance of TFRK and stressed that:

- Indigenous knowledge should be better integrated with scientific knowledge.
- For sustainable management to be attained, conservation of forest resources must be linked with the development needs of rural populations dependent on those resources.

IUFRO Task Force on TFRK

A Task Force on Traditional Forest Knowledge was established by IUFRO 2005 for a term of 5 years. The primary aim of the Task Force on Traditional Forest Knowledge is to increase understanding of the inter-relationships between traditional and formal (scientific) forest-related knowledge and catalyze potential synergistic applications for sustainable forest management (http://www.iufro.org).

FPRD for Tropical Forestry Research Priorities

The 5th Framework Programme on Research and Development (FPRD) for Tropical Forestry Research Priorities (http://www.etfrn.org) highlighted that “Being a logical complement of the decentralisation of forest management, the present day, fancy for traditional knowledge, challenges researchers for several reasons. Firstly one should try to comprehend, sort out the fashionable aspects and 'find out about' what should be transferred into the field of science. The work at hand therefore consists of collecting this kind of knowledge, and making an inventory. One should also try to see what effect the implementation of this traditional knowledge may have on forests”.

The Indian Perspective

India has responded to its ratification of the Convention on Biological Diversity with a National Biodiversity Strategy and Action Plan (NBSAP) which has as one of its main objectives the broad participation of local groups, the sustainable use of biological resources and benefit-sharing at all levels. However, the existing 1988 National Forest Policy, whilst envisaging local involvement in the development and protection of forests, ‘essentially remains a broad statement of government intent and does little in the way of specifying any legal rights or duties owed to forest communities [or to] tribal/indigenous peoples’ (Debbarma 2004).

The Indian government responded to this need through the promotion of Participatory Forest Management (PFM) and Joint Forest Management (JFM), emphasising their efficacy as means of regenerating degraded forests. According to official policy documents, some 14 million hectares of forest are now being maintained through over 65,000 Village Forest Protection Committees. But implementation of this approach has taken hold only in certain states, and JFM has not been accompanied by the necessary changes in the Indian legal framework, with management responsibilities being assigned to local communities merely as an administrative arrangement (http://www.un.org).

Issues related to TFRK

While there is a lot of interest in understanding traditional indigenous knowledge, it is important to assess its long-term potential in the context of larger social and economic changes. Some of the issues that may be considered are:

- Are there any efforts to apply scientific tools and techniques to improve traditional indigenous knowledge?
- To what extent could such knowledge supplement and complement modern science in developing practices and techniques for resource management and utilization?

- To what extent has such knowledge actually helped to address the emerging problems relating to resource management?
- Issues regarding the wider application of TIK *vis-a-vis* knowledge based on modern science.

Conclusion and Recommendations

The IPF and World Forestry Congress reports present the opinions of people in charge of forest services and managers. They express the demands made by people who make use of the results of our work.

People's involvement is essential for preservation, improvement and protection of forests. The increasing emphasis being placed on sustainable forest management, which includes ecological, social, cultural, spiritual, and economic sustainability, should encourage greater collaboration among government agencies, forest managers, local and indigenous communities, and the scientific community in the definition of forest management objectives and forest management practices that meet diverse criteria for sustainability.

At present, there is a need for a systematic global effort to explore and strengthen the linkages between TFRK and scientific forest-related knowledge (SFRK) systems, and to develop effective synergies between TFRK and SFRK in forest management applications. Traditional knowledge has been a backbone of resource management for a long time and continues to be important for local communities in the absence of access and ability to apply knowledge based on modern science. TFRK should be preserved and utilized in actions for sustainable forest management. TRFK usage would play crucial roles in forest conservation.

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FOREST RELATED POLICY IMPLICATIONS IN BHUTAN WITH SPECIAL REFERENCE TO THE BROKPAS

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Introduction

The tiny land-locked Himalayan kingdom of Bhutan extends from 26°40' - 28°15' N and 88°45' - 92°10' E, and spans over a geographical area of 38,394 sq. km. The country stretches from 160 meters above sea level in the southern foothills to over 7,500 meter towards the northern mountains, and exhibits diverse ecological wealth, which makes it one of the worlds' top ten biodiversity hot spots. The country maintains 72.5 percent of its geographical area under forest cover, including 26 percent declared as nature parks and wildlife reserves, and 9% as biological corridors.

While many countries ignored the inevitable consequences of environmental backlash in favour of quick economic returns, Bhutan pursued a cautious, environmentally-friendly and sustainable approach to development that is guided by the concept of Gross National Happiness (GNH) rather than Gross National Product (GNP). The need to adapt and tackle the challenges imposed by modernization, globalization, democratization and decentralization have led to the formulation and implementation of various policies and legislations, amongst which forest related issues emerge as the most elaborate and crucial one. This paper examines the implication of these policies on the livelihood of the 'Brokpas' or the herding community in Eastern Bhutan.

Methodology

The understanding of the forest related policies and its implications are primarily based on empirical research methods. The two villages, namely Merak and Sakteng were selected mainly because they represent a unique Himalayan ecosystem and the traditional yak herding communities, whose livelihood are solely dependent on forest resources. Primary data (both quantitative and qualitative) were collected from the two villages through a set of questionnaires and personal interviews. Various documents were reviewed to understand the forest related policies and its implications on the livelihood of the people. Other primary and secondary sources were then consulted and referenced to very the ground realities and supplement the findings.

Forest Related Policies and Legislations

Bhutan had no definitive forest legislation or policies until the late 1960's. Traditional institutions and local beliefs, including formal and informal rules and norms promoted the conservation of the environment. It was the introduction of the First Forest Act of Bhutan in 1969 which led to the declaration of all non-registered forest land as state property, and nullified the role of traditional institutions. This was followed by the declaration of the first National Forest Policy of 1974, which placed strong emphasis on forest conservation above all other considerations, and asserted that more than 60 per cent of forest cover will be maintained at all times. Though the policies related to collection and use of some non-timber forest products were less stringent and more considerate, communities lost their customary rights and regulatory function over forest resources, and with it many of the indigenous knowledge systems and community-based regimes for natural resource management disappeared (RGoB 2002). It was only after nearly two decades that a new "National Forest Policy of 1991" (yet to be passed by the National Assembly) was formulated. This Policy does ensure a rational management of forest through people oriented program guided by sustainability principles, social justice and equity. The realization that sustainable resource management cannot be achieved entirely through conventional bureaucratic and technocratic approaches further led to the replacement of the Forest Act of 1969 by a new 'Forest and Nature Conservation Act of 1995', that provided greater rights, protection and community participation in forest management. The need and desire to balance economic development with cultural and environmental conservation - referred to as

the 'middle path' is strongly expressed in 'The Bhutan Vision 2020', and further affirmed by a specific vision and strategy for nature conservation (Tshering *et al*. 2003).

Policy Implication on local resources and the livelihoods of the Brokpas

Inhabiting the greater Himalayan region of above 3000 meters the Brokpas (Brog-pasture and pa-inhabitants) synonymous to nomads or herdsman are the semi-nomadic people of Merak (place of fire) and Sakteng (bamboo plain). Their herding territory ranges from about 2500m to 4500m above sea level in winter and summer respectively. Studies carried out in 2000 enumerate the Brokpa population to be about 4034 persons distributed over 15 villages and 543 households (Chand 2004). The nature of their livestock can be imagined from the fact that the composition of yaks, cows, horses and sheep, which constitutes their main livestock amounts to an average of 36 per household, with yaks alone amounting to 20 per household (Table 1).

Table 1. Demographic & Livestock composition in Merak and Sakeng villages.

District	House holds	Population			Average Household Size	Total livestock Population				
		Male	Female	Total		Yaks	Cow	Horses	Sheep	Total livestock
Merak	213	1017	891	1908	8.9	4411	1962	1082	2852	10307
Sakteng	330	1089	1037	2126	6.4	6507	484	724	1638	9353
Total	543	2106	1928	4034	7.65	10918	2446	1806	4490	19660

Source: Computed from Chand 2004.

Until recent years the forest related policies of Bhutan had very little influence on the livelihood of the Brokpas, mainly because of their isolation, unrestricted utilization of the resources, and lack of monitoring and implementing agencies. But, of late there have been several reports of conflict between the Brokpas and the local residents for their winter pasture land over grazing rights. This can be attributed to increasing livestock and human population, family fragmentation, and shortage of grazing land. The conservation policies of the government also led to the establishment of the Sakteng Wildlife Sanctuary in 2003, which covers 650 sq. kms of Sakteng's geographical area. The park officials complain that girding, looping and illegal poaching, had caused major damage to the environment, and without the policy initiative it would not have been possible to check the degradation of forest in this area. But the local communities feel that their movement and grazing rights have been restricted and they have been deprived of the forest resources. They also fear that the new rules and regulations could further deprive them of their right over pastureland and threaten their livelihoods. Wangchuk *et al* (2006) reveals that the conflict over the natural grazing land between the two communities of Merak and Radhi is due to the shortage and tremendous pressure on pasture land, which is utilized by the permanent inhabitants of Radhi during summer and grazed by the cattle of Merak during winter. Independent sources report that the tension created by the rules and regulations for conservation vis-à-vis the pressing need for modern development has led the people to believe that environmental protection and conservation is an obstacle to economic prosperity (Pelden 2007), and the life of the Brokpas have been made more difficult after the establishment of the Sakteng Wildlife Sanctuary (Dema 2007).

A random survey of 72 persons in Merak and 57 persons in Sakteng was carried out to understand the problems related to forest resources. Analysis of the various complains related to firewood, fodder and grazing land indicated by the respondents revealed four common problems, namely the difficulties in obtaining permission, restriction, distance and shortage. People of Merak complained about getting permission, restriction and the long distance they have to travel to obtain firewood. Restriction and shortage of fodder emerged to be the most persistent problem related to grazing land (Table 2).

Obtaining the permits, restriction and shortage of firewood, restriction and shortage of fodder, and the distance and shortage of grazing lands were reported as the major problem of Sakteng village (Table 3). Problems related to restriction and shortage of firewood, fodder and grazing land emerged to be the most common complains of the people in both the villages.

Table 2. Problems faced by the people of Merak.

Problems related to	Firewood	Fodder	Grazing Land	Total
Permission	21	8	14	43
Restriction	17	27	15	59
Distance	16	3	15	34
Shortage	7	21	19	47
Unspecified/others	11	13	9	33
Total Respondents	*72*	*72*	*72*	

Table 3. Problems faced by the people of Sakteng.

Problems related to	Firewood	Fodder	Grazing Land	Total
Permission	17	5	7	29
Restriction	18	23	9	50
Distance	4	2	11	17
Shortage	13	18	24	55
Unspecified/others	5	9	6	20
Total Respondents	*57*	*57*	*57*	

The assessment of the ground realities in the study area indicates that the policies related to the control, use and management of forest resources tends to overlook the needs of the local people. Firewood, timber, fodder and grazing land have become less accessible to people, and the distance they now have to travel to maintain their lifestyle is increasing beyond their normal territory. The 'Forest Management Code of Bhutan' (FMC); the Integrated Conservation and Development Programme (ICDP), and the Participatory Forest Management Project (PFMP) provide good examples that aims at strengthening the capacity of local communities to utilize and conserve forest resources, and address the conflict arising out of forest related policies, which are yet to make much impact on the livelihood of the Brokpas. There is also a need to neutralized strict conservation policies with alternative means of meeting basic needs of the affected population. Biological conservation can be of interest to the local community only when it benefits and provides utility value.

Sharma *et al* (2005) illustrates how policy intervention for pilot testing by opening up collection of Cordyceps in some areas of Bhutan provided economic benefits legally to the local communities, generating interest amongst them for sustainable harvesting and conservation of its habitat. Harvesting of mushroom, medicinal plants and other NWFPs, and eco-tourism are some of the promising alternatives for the local communities of this region. Effective silviculture; system that guide the management of forest ecosystems according to defined values and objectives; well-defined planning and monitoring systems including property rights and resource security; attention to the livelihoods of forest-dependent people; and development of appropriate institutional or management structures and frameworks, suggested by Brown *et al* (2005) can serve as the necessary conditions for successful forest management and policy interventions.

Conclusion

The physical, cultural and socio-economic setting of Bhutan makes it necessary to maintain at least 60% of its geographical area forested in perpetuity. While the nation is currently placed at the comfortable environmental zone, the brunt of placing conservation above economic development have often been felt by the communities whose livelihood directly depend on forest resource. The case studies of the Brokpas have revealed that they are facing difficulties due to forest related policy implementation. This signifies that the role of forest resources needs to be revitalized and supported by compatible management strategies and policies. The meaning of conservation is best derived when the socio-economic needs of the people are fulfilled. Therefore, the adaptation of the community to emerging forest policies; maintenance of a close linkage between the people and forests; supporting institutional arrangements, are some of the areas which need to be further scrutinized and explored by researchers, planners, decision and policy makers at the national, regional and international level.

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FOREST MANAGEMENT PRACTICES OF THE TRIBAL PEOPLE OF MEGHALAYA, NORTH-EAST INDIA

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Introduction

Tribal communities of Meghalaya have nurtured forests in the vicinity of their habitations, near water sources, on the steep slopes and other ecologically sensitive lands for ages. These forest patches are locally known as *Law Kyntang, Law Lyngdoh, Law Niam, Khlaw u Blei* (Sacred Forest) *Law Shnong* (Village Forest), *Law Adong* (Prohibited Forest), *Law Ri Raid* (Forests belonging to a group of villages), *Law Ri-Sumar, Law Lum Jingtep* and *Law Kur* (Clan Forest). In modern parlance these forests are called community forests (CFs) or community conserved areas (CCAs). They are protected and managed by the local people through an institutional arrangement for the common good of the community as a whole. The classification, protection, regeneration and extraction procedures followed for management of these forests are among the best examples of traditional ecological knowledge. Ninety-two per cent of Meghalaya's forests belong to this category. Often including a variety of water bodies, these forests are very rich in aquatic as well as terrestrial biodiversity and are the treasure houses of innumerable medicinal plants, wild edible species and other economically important plants and animals.

Local health traditions in Meghalaya are widespread and popular. The state has a large number of herbal practitioners found in almost all human habitations. The tribal communities (Khasis, Jaintias and Garos) which constitute the majority of the rural population are dependent on these practitioners who use herbal products for treatment of the ailments and diseases. The CFs and CCAs are the major source of herbs utilized in the health care systems. The conservation of the community forests are part of community conservation practices evolved over hundreds, if not thousands of years and passed on from generation to generation. Local people also have a rich tradition of environmental conservation based on religious beliefs and customs. It is believed that the forefathers of these communities, had conserved these forests keeping equity concerns in mind especially to safe guard the interests of the poorer members of the community, including the landless. This study documents and analyzes the role played by these forests and associated knowledge in conservation of biodiversity in general and medicinal plants in particular. The paper also highlights the traditional holistic forest management system of the Khasi people which takes care of soil and water conservation, food security, health care as well as ensures perpetuation of forest related traditional knowledge.

Methodology

Secondary data for the study were collected from both published and unpublished literatures. Primary data pertaining to forest management and use of medicinal plants were collected using a combination of semi-structured interviews, group discussion with villagers, key-informants and key resource users viz., health practitioners, chiefs of traditional institutions. This was done in two parts, a macro-analysis which covered the whole state of Meghalaya, and a micro-analysis and survey which was conducted in three selected community development blocks, Pynursla, Mawphlang and Umling, located in three agro-ecological regions of the state.

Results and Discussion

Conservation and Management of Forests

The study revealed that the tribal people of the state are actively involved in traditional conservation and management of the forest which is done through traditional institutions which are regulated by the Autonomous District Councils (ADC). The traditional institutions and ADCs act as regulatory authorities as per the 'Customary Laws' supported by the Section 3 (a) of the Sixth Schedule of the Constitution of India; the real authority over these forests lies with the concerned owners who can be a village council, a clan council, or a family. These forested areas are protected mainly for the ecosystem services they provide such as water, wild fruits, fire wood, NTFPs, poles, etc. and common

needs, but they indirectly help in the conservation of innumerable MPs. These forests are classified with respect to their systems of management. Some of these are briefly described below.

Private Forests (Ri-Kynti): These forests belong to clans or joint clans on inherited recognized private lands, Law Ri-Sumar: These forests belong to an individual clan or joint clans and are grown on inherited or village or common Raid lands, Law Lyngdoh, Law Kyntang, Law Niam (Sacred Forests). These forests are set aside for religious purposes and are managed by the religious heads (Lyngdoh) or other persons to whom the religious ceremonies for the particular locality are entrusted. *Law Adong* and *Law Shnong*: These are village forests reserved for the village and managed by the Village Chief, or headman with the help of the village council. *Raid Forests*: These are forests looked after by the heads of the Raid and are under the management of the local administrative head. Tiwari et al. (1998) identified 79 sacred groves and their floristic survey revealed that these sacred groves are home to at least 514 species representing 340 genera and 131 families. TK based community forest management practices have enabled the community to make best use of the resources in a relatively sustainable manner. It has also helped in protecting the rich biodiversity of the area (Tiwari 2005).

Role of CFs and CCAs in the conservation of medicinal plants: Medicinal plants are a vital resource for the traditional health care systems, as well as for modern medicines. It was observed that density of CFs and abundance of herbal practitioners are often correlated. Out of a total of more than 200 medicinal plants recorded in the state during the study, only 18 species were found to be used by all three tribes (Khasi, Jaintia and Garo) in Meghalaya indicating that each community has evolved their system independently. It has been observed that 107 species were used by the Khasis, 53 by the Garos and 18 by the Jaintias. Eighteen medicinal plant species were found to be used by tribal people for treatment of more than one ailment. The species which are used for treatment of more than two ailments included *Acorus calamus* (6 ailments), *Aegle marmelos* (6 ailments), *Centella asiatica* (4 ailments), and *Emblica officinalis* (3 ailments) among others. Some ailments are treated by more than one plant. For example: Fever (18 species), headache (19), diarrhoea and dysentery (19), cough and cold (14), stomachache (11). The distribution and use of medicinal plant species was also found in four agroecological regions of the state irrespective of the tribes or communities. It was observed that 58 wild and domesticated medicinal plants were used by the people living in the Western Region, about 103 species from the Central and Upland region, 52 species used by people in the Northern Undulating Hills and 85 species by the people in the South Precipitatious region of Meghalaya.

Role of CFs/CCAs and livelihoods: CFs and CCAs provide numerous goods and services on which many rural poor are dependent. Some of the forest products include: medicinal plants, bay leaf, wild pepper, lichens, broom grass, mushrooms, fuelwood, bamboo, cane, variety of wild edible fruits and vegetables, pole, construction materials etc. Collection, processing and marketing of medicinal plants and other forest products play an important role in the economy of the tribal communities living in the vicinity of forests of rural Meghalaya by providing a source of cash income. The processing and marketing of these products also create opportunities for setting up of small-scale industries at the local and regional level, generating employment to people.

Conclusion

The study brings to fore that traditional forest management systems have helped a great deal in conservation of forests, acting as a source of medicinal plants for thousands of tribal folk herbal practitioners who are the backbone of the state's health care system. As pressures on these plant resources increases, people have now realized that there is a need to conserve the traditional knowledge, promote traditional institutions, and using these conserve the forests, water and land resources. This research shows that all these are interdependent and thus loss of any one is bound to affect the other. CFs and CCAs also provide best example of *in situ* community conservation practice which has all ingredients of a working wise management of natural resources in a mountainous region where reach of government managed public health care system is far from satisfactory.

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THE CURRENT STATUS OF OLD AND VALUABLE TREES IN RURAL GUIZHOU AND A DISCUSSION OF PROTECTION MEASURES

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Introduction

Guizhou Province is located in Southwest China and in the eastern part of Yunnan-Guizhou Platea. It is a very mountainous region and the home of a number of ethnic minority groups with diversified natural environments and folk customs. In these rural areas, there exist many old and valuable trees of different species and many are unique to the local area. Relevant official statistics show that Guizhou has more than 100,000 old trees, which does not include the old trees kept in nature reserves and the forestry parks. For example, tree species such as Guizhou cycads (*Cycas revoluta* Thunb.), *Keteleeria fortunei*, Jingyan (*Larix gmelinii* (Rupr.) Rupr) and *Ormosia hosiei* are unique to Guizhou (Zhang 2000, Zou 2001).

The wide distribution of old and valuable trees in rural areas is a great material and cultural heritage for rural communities inherited from their ancestors. The trees represent a record of these communities development and the evolution of indigenous knowledge over time (Zhang 2004). Today, these trees remain strong and vital and create picturesque landscapes, and can enlighten us with greater love of nature.

With regard to rural communities, the cultural values of old and valuable trees are related to the regional religious culture, customs, ethnic spirit, production activities of everyday life, local knowledge, and so on. In addition, the old trees in villages show the historical benchmarks in afforestation activities by communities. Moreover, these trees are closely linked to formation and evolution of ethnic culture and forestry culture (such as Feng-Shui woodlands, protective trees, sacred trees).

With socio-economic development, governments at all levels have started to understand the importance of protection these old trees. The study of these trees has received great attention and support from governments at various levels. However, no special regulations or technical framework has yet been developed in Guizhou or in other regions of China to protect old and valuable trees in rural areas. The protection of these trees still depends on voluntary actions by individuals or rural communities or are managed under the rules established by villages. Due to the lack of proper institutional settings or supervision, most of the trees in the villages are not protected, and are occasionally destroyed or illegal logged.

To date, few people have carried out in-depth studies in sociology, history, ethnology and anthropology related to these ancient trees. Relevant topics for research include: the historical culture and ethnic culture represented by old and valuable trees; the reason why the old and valuable trees are being well protected in some ethnic residential areas; the role of protection mechanism of the old and valuable trees in community management and community development; and the indigenous knowledge represented through local protection mechanisms.

Methodology

Participatory Rural Appraisal (PRA) methodologies and tools were used to interview local experts and community residents through semi-structured interviews and oral records. Relevant historical data and legends were also collected as well. The purpose or our study was to derive cultural information and traditional knowledge from these data, as well as the customs, practices and results of protection of these trees by the community; and the role of customs in protection of old and valuable trees and

local community management. In addition, the formal policies, laws and regulations relating to protection of old and valuable trees were also examined and analyzed.

Discussion and Conclusions

Inadequate protection of trees

Legal provisions including laws, regulations and management systems need to be improved. The there are no special provisions related to the protection of old and valuable trees in the Forest Law of PRC. However, in the Provision of Urban Landscape PRC there are special clauses on protection of old and valuable trees, but only refers to urban and the associated planning zones, scenic zone, cultural relics and revolutionary memorials. There are still a need for laws and regulations on protection of vast old and valuable trees that are widely distributed over rural areas. The absence of such laws and regulations means the protection of old and valuable trees therefore presents difficulties for the protection of these trees and leaves much room for transgressions.

Table 1. Different knowledge systems and the protection concepts

		Government / Administrative / Scientific Research agencies	**Community / Ethnic Groups / Villages**
Cognitive System	**Old Trees**	≥100 years old	Legendary trees, holy tree, the tree for worshipping
	Big Trees	≥100 cm diameter trees	relatively large
	Valuable trees	Trees linked with historical events or the famous people	public places, geographical references
	Old and Big Trees in group	More trees clustered, in groups, in large numbers	Scenic views, Forest for water conservation, safeguard-village
Function / purpose		Ecological / Environmental studies, the gene preservation	Scenic spot , the village symbols, the place for worship
Forms of protection		Notices，registering，Signs	worship / Monument licensing, Village regulation
		Village leaders and few villagers	Whole village
Implementation/monitoring/ maintenance		forestry station, police station	Senior villagers, all villagers

Responsibility is not clear. In the context of existing legislative framework, there is no clear description of responsibility for the old and valuable trees around community residential areas, for old and valuable trees distributed in the cropland, valley and along the river courses. The question remain as who will be the main players to protect the trees - forestry agencies, local governments, individuals or the communities? What are their respective rights and their obligations?

Promotion is not sufficient. Most of these old and valuable trees are widely distributed in remote rural areas and only few such trees are located in scenic zones, cultural relic sites, and at revolutionary memorials. It's imperative to improve understanding of the importance of protecting the old and valuable trees among the communities in a proper way. The promotion of these ideas is difficult, particularly in the mountainous areas of Guizhou.

The funds for protection purposes are not sufficient. The resources assessment of old trees and valuable trees and establishment of baseline data had been financially supported by the government at various levels. However, the protection works have not been fully implemented due to the lack of funds to support promotion and protection activities. As a consequence, little protection work has been carried out to preserve these old trees by governmental forest agency.

Cultural knowledge is slipping away and requires efforts to document the traditional protective measure practiced by different ethnic peoples. Except for few trees carrying with clear cultural information, such as Dafang old ginkgo tree, Xiuwen Wencheng Cypress and Yinjiang Huishi Cypress, many trees have lost their links to traditional culture due to lack of interest in folk or ancient stories

related to these trees. As a result, some traditional and effective mechanisms for protecting these trees are vanishing. The loss of this traditional knowledge has led to low level of local participation to protect the old and valuable trees; further, local people have paid little attention to transgressions related to these trees.

How can the protection of old and valuable trees in rural areas be improved?

Improve relevant laws and regulations. The protection of old and valuable trees in rural areas requires supportive laws and regulations. There is no legal system to follow while dealing with destruction cases and there are few restrictions for potential transgressors. Therefore it is suggested that the national and local governments assign legislative work on this issue as a high priority.

Identify main beneficiaries. Who are the main beneficiaries, who are the direct beneficiaries is a issue that needs to be defined . The ultimate beneficiaries of protection opinions and measures are the people, regardless of the opinions and measures of forestry agencies or local government. The beneficiaries indeed are the local people and the communities where the trees grow as these old and valuable trees are the carriers of local traditional culture, ethnic culture, folklore and evolution of the community. Meanwhile, these trees play a positive roles in the local environment by providing local people with a better residential environment with greater potential to develop tourism business.

The active participation of communities. Community residents are direct beneficiaries of the protection of trees, but also a powerful force for their protection. Therefore they should be aware of the community's history, culture and be aware of the history, legends and stories carried on through these trees. To enable community members to be the main force in effectively protecting trees, it is important to arouse their interests. Information related to these trees that community members should be aware of and may find interesting may include, for example, what kind of temple used to be built at the village, what historical events were witnessed by this village, famous people who may have stayed here in the past, interesting folk stories linked to the site.

Research the culture. Most of these trees have particular cultural backgrounds. For example, the Wencheng Cypress at Guizhou Xiuwen is linked to the "unity of knowing and doing" subjective idealism system of philosophy of Wang Yangming. The giant ginkgo at Dafang is linked to Anna meeting with the King to ease ethnic disputes. The “Han” Cypress at Zhengan is linked to Yinzhen - a famous scholar of the Donghan Dynasty, a calligrapher and educational founder in Guizhou. The Taijiang Fur Tree is linked to Zhang Xiumei’s rebellion against the Qing Dynasty. Most folk stories that involve the old and valuable trees are carried on through verbal communication. Our investigation indicated that most of the old trees have strong linkages with folk stories and love legends. Some of these trees are linked with “Fengshui”; some are connected to remnants of old temples. Some trees however, have only have faint connections to local culture, with no supporting written or oral evidence, and for some trees, there are no clues about their history. Therefore, a systematic approach to collect and analyze the cultural information represented through these old and valuable tress is very important for their protection.

Make better signs. The plastic or aluminum alloy signs typically used to identify old and valuable trees may look good but are easily worn out. The content of the sign are typically not well understood by the villagers. Further, the signs can be misinterpreted as interventions from government and research agencies. Therefore, these sign should be made with the active participation of the community and private funds could be mobilized to help support the protection work. The content of these signs should include information such as the relevant historical and folk stories, the reasons for protecting the trees and relevant village regulations as well as names, ages and methods of use. Thus the information on these trees could be preserved for years for villagers and tourists in the same way that the existing ancient stone monuments can tell us about the past.

Make full use of traditional community management systems. In every community where the old and valuable trees grow the people have resided for a long time and communities have formed some special community regulations to protection these trees. The penalty for the transgressors could be some amount of meat, rice or wine. In many Miao and Dong Villages, many people burn incense in front of trees or decorate trees with red cloth. The villagers regard the trees as holy trees which can bring them peace and health. Although this may be considered to be superstition, the result is effective protection of these trees.

Promote the protection of old trees through development. With the improvement of people's standard of living and the development of tourism, recreation, rural tourism, and cultural tourism has

drawn increasing interest. Residents of rural communities should be assisted in developing tourism business. Collection and introduction of traditional culture, national culture, stories, legends carried on through the local trees can be part of this, and allow the community residents to realize the benefits from protection of local trees, and more actively participate in their protection.

Conclusions

Old and Valuable Trees with rich cultural information are the treasure inherited from the nature and ancestors. Nowadays the widely distributed trees in rural communities are still facing a short of protection fund, lack of supportive legal system and lack of care from local communities. This paper is developed to introduce protection ideas with a view to arouse interests and attention from the society.

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KAM'S TRADITIONAL BUSINESS KNOWLEDGE AND SUSTAINABLE LIVELIHOODS

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Kam Traditional Forest-related Knowledge

Forest Technology

The Kam people divide the forests into four categories: fir forest (for timber), sacred forest (for Feng Shui), fuelwood forest, and water conservation forest, according to their different utilization and functions. Fir is only choice of construction, and the landscape forests and grave forests are included within the sacred forest category. Water conservation forest is considered as multi-function forest, which in practice can be used in many ways. The zoning of forest is based on forest types, farming regions, housing location and altitude, and mainly depends on the altitude.

In Kam community, the rice paddy is mainly located in the flat areas near water (on embankments) and on the mildly sloping mountain foot areas (terraces), except those that are forested or used for other purposes. Across an altitudinal gradient, the forests are: water conservation forest (the waterhead of the rivers and the brooks which for irrigation); fuelwood forest; fir forest; and grassland for grazing. Since the Kam livelihood mainly depend on rice planting, small dry land plots are scattered under the forests.

The forests surrounding the community play multiple functions: for landscape, Feng Shui and water conservation. The local people call this sacred forest or community protection forest because its harvest is strictly forbade. Most of this kind of forest is natural forest, mainly comprised of broad-leaved species, although there are a few conifers such as Chinese fir. In Kam people's tradition, broad-leafed forest plays a vital role in the prosperity of their community and prevents their drinking water source from drying up.

The Kam people always plant the grave forests in the mountainside - just above the rice paddy - which also contributes to water conservation. In Kam people's opinion, the grave forest is a community for deceased persons, who also need the protection of forests. In this regard, the grave forest is sacred to a certain degree.

The water conservation forests are natural forests that also provide organic fertilizers to the rice paddies. But they are not completely natural because the Kam people only retain the broad-leaved tree species and some other trees that are considered important for water conservation like maple and alder, while other tree species are harvested.

The fuelwood forests are also natural, mainly broad-leaved, forests. Due to its major function in supplying fuelwood, it can be managed by clear cutting or thinning. When the Kam people decide to harvest all of trees in one plot, they adopt a type of rotation harvest system: the whole harvest area is divided into several small sections, and then harvest one of them each year. Depending on the condition of the forest, they are usually divided into 5 to 10 parts. If a thinning harvest is chosen, the larger trees are cut down and the smaller ones are retained. After harvest, the Kam people leave the timber to dry on the hills; when working in the nearby farmlands, they fetch the dried timber home as needed. Furthermore, the Kam people only harvest once every year to protect the forests.

Forestry Institutions

The traditional laws of Kam people, and the historic persons who made significant contribution to afforestation and forest conservation, are recorded as good examples to be admired and remembered by the later generations through poems or songs. Sometimes the Kam people name the forests after these famous people. These laws and customs also have an important role in persuading and

preventing deforestation, for example through the stories which are passed down from one generation to the next about people who were punished for their forest-damaging actions by mysterious forces such as ghosts and gods.

In the sacred forests harvests are very strictly forbidden. Persons who break the law will be fined very heavily and be asked to re-plant trees. Further, the Kam people believe they would be punished by the ghosts and gods for their actions.

In the Kam community, the land tenure of rice paddy always includes the grassland and forests around it. The owner can collect the new branches and leaves for fertilizing the farmland, but not the trees. Poaching in somebody else's forests is considered by the Kam people to be a crime as serious as stealing food stealing.

The fuelwood forest is the main source of the Kam people's firewood. The Kam people think the big trees provide spiritual meaning for their daily life, so they never cut any very large trees in fuelwood forests.

The Kam people usually plant firs collectively in spring, after Chinese Spring Festival. In some communities, there is a tree-planting day arranged by informal institutions, and on these days all of the labor force are asked to join in this activity before rice planting.

Forestry Culture

The abundant forest-related knowledge is embedded in forestry culture, which is an impetus for sustainable forest development in Kam communities and an important part of their folk beliefs. The Kam people's everyday custom and production habits are characterized by it. For instance, they believe the forest is the symbol of vitality, the evergreen tree symbolizing peace and the growing season meaning the revival from death. Another example is their traditional clothing, in which the symbols of trees like maples and firs appear in embroideries and silver ornaments, especially the ones for children for their blooming vitality.

The Kam architecture can be treated as high achievement of forestry culture, and includes folk houses, and particularly drum towers made of wood, and bridges such as the Wind-Rain Bridge (known as "Feng Yu Lou").

The famous "Eighteen Years Fir" is one of the customary habits of the Kam people. When a girl is born, her parents plant firs which will be harvested for her trousseaux when she marries about eighteen years later.

In Kam people's belief, trees are the incarnation of the Earth God, and except for exceptional necessary occasions, nobody is supposed to cut down any big trees. Furthermore, the ones along the main road are treated as their elders; some people even bring joss sticks to them on important occasions like calends and full moon days. Sometimes when children are sick, the parents believe it is a punishment from trees for their defects in raising children. So they need to give prayers in front of the trees.

Forests and the Kam People's Livelihood

Historically, the Kam people have practiced permanent agriculture, so they give much attention to housing construction, from location selection to building materials. For thousands of years, fir has been the only construction tree widely used in drum towers, Wind-Rain Bridges and hanging houses, which are famous elements of their characteristic architectural heritage. Their improved architectural techniques and skills, have also provided a remarkable impetus for fir planting. In history and in modern times, the export of their construction labor and skills has been is important income source of Kam community.

During the Ming Dynasty, the Kam area was controlled by central government for the first time, and most of the government buildings and big cities in this region were built by Kam technicians, and fir was designated as "Royal Material". The rising price for fir timber stimulated expansion of the area of fir planting and improvement of these skills. During the Qing Dynasty, when the area along the Duliu and Qingshui Rivers became the largest production base and sale center for fir timber, the traditional Kam culture and the Kam people's livelihood were promoted, resulting in the rapid development of the entire Kam community.

Apart from rice, the Kam people mainly live on the fruits, vegetables and wild animals from the forests. After so many years collecting from the forests, the Kam people have developed an understanding of hunting practices for different species throughout the year, and have even developed improved regulations and other informal institutions in case of natural resource being exhausted. For rice planting and subsistence, water is the most important natural resource. In Kam people's folk songs, migration is always due to drought. So they pay a lot of attention to water conservation and consider water as the source of life. For example, in Zhanli village, the villagers think the forests are water and the communities are the boats, so the forests are strictly protected, especially the 2 km of forest area surrounding the village.

There is a Kam old saying, "the forests are the hosts but also the guests". They treat the forests as humans with lives, and their peace is not supposed to disturbed by anybody.

The Forest and Poverty Alleviation

The forests contribute significantly to poverty alleviation in Kam communities, and play a vital role in their livelihood assets and livelihood strategies. More importantly, the diversified cultural and ecological values embedded in forests provide more opportunities for poverty alleviation and sustainable development. Timber production contributes significantly to the Kam people's livelihood and economic development. In addition, the abundant Non-timber Forest Products, such as natural herbal medicine, wild mushrooms, have high potential to exploit for commercial and nutritional value. Eco-tourism is another booming industry in the Kam's area, based on the unique landscape and their traditional culture. Southeast Guizhou is one of two "Back to Nature - the Resort of Tired Soul" sites awarded by the United Nations.

Traditional forest-related knowledge, along with the forest culture of the Kam people, is an important part of their society and livelihood, rooted in the unique and profound understanding of forests, and embodied in their folk beliefs and customary institutions.

SETTING A PRICE ON INDIGENOUS KNOWLEDGE? A CASE OF THE MEDICINAL TREE (*ALSTONIA SCHOLARIS*) IN SOUTHWEST CHINA

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In an open social environment, indigenous knowledge, due to its geographical limitation, oral transfer and changeability, can easily disappear or face away. This paper presents a story about what happened to indigenous knowledge on a medicinal tree species, *Alstonia scholaris*, in Southwest China.

The local people, Dai, Lafu, Yao, Hani in the Southern Yunnan China have used the medicinal tree species, *Alstonia scholaris*, to treat cold, cough and bleeding for hundreds years and formed a knowledge system on this tree, including its biological properties, habitat, growth and reproduction as well as the collection, storage and utilization of the tree. Due to the wide application of modern medical treatment during 1970s, in particular the decrease of this tree in the field, *Alstonia scholaris* was no longer used for medicine as the past and the indigenous knowledge associated with it was also ignored. On the other hand, the local medicine institutions had begun pharmacological research and companies started to develop new drugs and preparations from medicinal plants used by local people. In this process, new knowledge that utilized traditional knowledge has been developed for *Alstonia scholaris*, including its cultivation, processing and pharmacology, and the medicinal value and cultivation of this tree have been promoted. The local people who have held the indigenous knowledge of this tree for generations were also involved in the cultivation of this tree. Up to the late 1990s, this tree was not only used for medicine but also for urban greenbelt, garden and restoration of degraded fields.

It is clear that the indigenous knowledge of *Alstonia scholaris* is tied to its practice value. The more the plant is used in practice, the more vitality this knowledge has. In another words, the conservation of genetic resources is the basis for the conservation of the traditional knowledge of this species. The local medical institutions and companies that apply the "old" indigenous knowledge of *Alstonia scholaris* to the development of "new" indigenous knowledge should be considered as the promoters of the same knowledge but in different situations.

However, in terms of interest, companies get much more from *Alstonia scholaris* and the indigenous knowledge associated with it, if markets are the only criteria. In response to the good market for this tree and its products, local companies have encouraged farmers to cultivate large areas of *Alstonia scholaris*. But conflicting interests among different users for these trees disrupted the planned production chains. In 2005, the price of final product was 20 times of that of the raw materials, and some farmers did not sell raw materials to pharmaceutical companies but instead sold the young trees to garden companies.

Funds, techniques and information are basic costs for market product. Medicine indigenous knowledge belongs to the information cost for pharmacy related to indigenous knowledge but is neglected once the pharmacy markets bloom. To balance the interests between the indigenous knowledge inheritors and companies, it is necessary to develop some kind of mechanism at national level to establish a price for indigenous knowledge, and for promoting the development of national product related to indigenous knowledge.

TRADITIONAL ECOLOGICAL KNOWLEDGE FOR FOREST MANAGEMENT IN THE UPLANDS OF ASIA: IMPLICATIONS FOR ECOSYSTEM RESTORATION AND ECOSYSTEM SERVICES IN THE ASIAN WATER TOWER

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The Mountain Citizens

If everyone lived like the farmers and herders in the highlands of Asia, often called the Asian water tower, there would be no global warming. On a per capita basis, these subsistence-based indigenous people consume less from and contribute more to ecosystem services than modern energy-intensive lifestyles in urban regions. Within mountain ecosystems, there is delicate a balance between humans and nature although forests have been cut and regenerated, pastures grazed, and lands intensively tilled using rotational cropping systems. Traditional farming practices fostered useful species, protected forests, and maintained rangelands and waterways. Many of these management systems are intertwined in range of cultural beliefs and mores that incorporate, taboos, language, technical practices, knowledge transfer, and customary institutions for social consent and governance which together comprise what is commonly called traditional ecological knowledge (TEK).

Changing Environmental Conditions in the Asian Water Tower

Asia's changes have been rapid and dramatic. Those changes are best illustrated by a sustained high economic growth rate, with millions of people lifted out of poverty. But development in Asia, led by two giant rapid-economic-growth engines, China and India, is in overdrive – not just in the lowlands but eventually in the uplands and highlands as well. However the fossil-energy based economy has largely contributed to CO_2 emissions and global climate change. Although CO_2 emission per capita is still below the global average, China will surpass United States and become the largest emitter in the world. On the other hand, Chinese farmers have planted more than 4 million hectares of trees per year from 2000-2005 according to FAO (2007). The How can policy-makers and scientists work together to rediscover and revive traditional technological knowledge, innovations and practices for managing, nurturing and sustaining the diverse forest landscapes? What are the national and regional agenda for deliver of better conservation and development outcomes from the Asian water tower?

Changing Society in the Uplands

The people living in the upland watersheds continue to be blamed for environmental degradation and are paying the price for past over-exploitation often led by downstream interests. The implementation of massive reforestation programs, and the establishment of nature reserves and watershed conservation programs often result in local communities being denied access to and benefits from their traditional lands and livelihoods. The policy makers are well aware that the mountain periphery is on the wrong side of the nation's ever widening poverty divide. Confronting this inequity, for instance, the Chinese government is pursuing "Develop the West and Construct New Countryside" policies to bring new industries and opportunities to remote regions as rapidly as possible. The immediately obvious results are the expansion of road and transport links, attempts to improve communications, and development of tourist infrastructure. Significantly, these programs aim to enrich the uplands, rather than exploiting them for the benefit of the downstream lowlands. However, the fast pace of change poses a threat to the stability of minority communities: greater access, market exposure and out-migration are eroding traditional ecological knowledge and communal institutions, often leading to overexploitation of local resources as communities attempt to cash in for short-term gain.

Building New Relations

The relationship between human and nature has been forged within religious, moral, cultural, political, economic, and ecological boundaries. Respect for these boundaries by different communities and social groups were the result of historically accepted rules and norms. The traditional culture in the highlands and uplands of Asia, combined with indigenous management strategies for natural resources, have succeeded in maintaining ecosystem goods and services, and have effectively managed biological diversity and ecosystem functions in their environment over a long period of time. In some cases, traditional ecological knowledge of resource use is linked with craft production, bio-prospecting and the development of tourism products. In the transition to a market economy, culture and ingenious practices become 'exotic', 'profitable' or 'social capital' instead of 'backward' – these valuations of cultural resources have been defined by outsiders, including powerful State authorities, entrepreneurs and development agencies.

Regional Cooperation

Many of these problems are of concern throughout the region. Climate change, glacier melting, water shortages, transboundary disaster risks, desertification throughout central Asia are well-recognized issues. While river basin management is becoming critical, the regional cooperation is inevitable. There is growing awareness that management policies and research must be more aware of and adequately address local beliefs and institutions at headwaters of rivers, using both customary authority and elected village committees to help implement policy. This change in attitude is a pragmatic reaction in an attempt to realize achievable environmental outcomes by using the long experience of people whose cultures have developed in these ecosystems. The challenge of environmental and cultural management is not unique to Asia, but given the rapid rate and magnitude of its economic growth, this is certainly an area that requires urgent investigation and action.

The Central Role of Indigenous Peoples

Following decades of State discouragement, the indigenous peoples in the highlands and uplands of Asia are once again able to follow (or revive) their particular cultural beliefs, knowledge and practices. They are combining their social and natural capital in fresh ways to respond to environmental changes driven by global warming, state policies and globalization. It is important to realize that traditional ecological knowledge is not necessarily static, pristine and culturally specific. Rather it is dynamic and continuously evolving for local and global adaptation and building harmony and prosperity Asian society.

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COMMUNITY - BASED CONSERVATION OF TRADITIONAL CULTURE AND BIODIVERSITY: A CASE STUDY IN BUFFER ZONE OF BAIMA SNOW MOUNTAIN NATURE RESERVE IN NORTHWEST YUNNAN, CHINA

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Introduction

At a time when ecological degradation and loss of biodiversity have been taking place at an alarming rate, a large number of plant communities and species are being preserved in various sacred natural sites in Northwest Yunnan - portions of landscape formed and traditionally protected for cultural belief purposes. In Diqing, a Tibetan Prefecture of Northwest Yunnan, local Tibetans believe that mountain gods, who live on the peaks, govern all the land, animals, and people. Each year, thousands of believers from Yunnan and other parts of the country embark on a pilgrimage to the mountain to worship and offer sacrifices and to perform the Buddhist prayer practice of *Zhuanjing* (walking around the mountain, which usually takes one month). Hunting, logging, or anything that may be considered as “polluting” the mountain is strictly taboo. The sacred mountains have constituted the local framework for nature conservation, and large areas of forests have been successfully preserved in the prefecture. In Northwest Yunnan, there exists a huge Tibetan sacred natural site system that combines sacred forests and sacred mountains. Within the system, cultural hierarchical rank stretches from the top echelons down to the community level. In this way, local Tibetan people share one or several sacred natural sites at regional and village level; they have their own sacred forests, forming the Tibetan sacred natural site system in Northwest Yunnan.

Baima Snow Mountain State Natural Reserve located at N 27^0 24´- $28^0$36´, E $98^0$57´-$99^0$25´, at an altitude of 1929-5429m, with a total land area of 281,640 ha, is home to 1835 vascular plant species which belong to 167 families and 627 genera. These include 883 species of endemic plants. The Reserve is the home of 50% of the Golden-hair Monkey (*Rhinopithecus bieti*) population (around 800-1000 individuals) within Natural Reserve (Yunnan Provincial Forest Department 1993). Local Tibetan people believe that the Golden Monkey is their ancestor, and hunting is not allowed.

However, Sacred Natural Sites (SNS) in Tibet area also face management and conservation challenges. These challenges include:

1) Multiple stakeholders with differing perceptions and demands;
2) Development pressure that can have significant adverse impacts on SNS, including forest encroachment, for agriculture, expansion pastoralism, hunting, logging, road-building, tourism and mining;
3) Environmental Pressure: anthropogenic and natural disasters such as pollution, climate change, fires, floods, erosion, and other related factors that create stresses which negatively impact sacred values and practices, as well as the physical integrity of sites;
4) Ownership issues, specifically the fact that SNS are located in areas not owned by the traditional custodians, and not within established protected areas, creating extraordinary challenges for management;
5) Economic considerations, particularly the difficulty in balancing the material and non-material values of an area especially so in the case of SNS;
6) Conflicting jurisdictions and integrated approaches to management - SNS may contain cultural resources managed by traditional custodians or government agencies that differ from the natural resource management entity. This may cause conflicts between the management perspectives or philosophies of the different entities, and make integrated approaches to management an ongoing challenge. The charging and allocation of visitor use fees is often a particularly divisive issue.

The project on “traditional culture and biodiversity conservation” is one of the components of the GEF Yunnan Programme. The objective of the project is to integrate biodiversity and cultural diversity conservation to promote community co-management and to develop methodologies and guidelines for the governance, planning, and management of Sacred Natural Sites (SNS) and Cultural Landscapes through pilot community-based conservation projects. The location of project is Kegong village, Tachen Township of Weixi County and Zhuida village, Benzilan Township of Deqin county, Diqing Tibetan Autonomy Prefecture in the buffer zone of Baima Snow Mountain National Nature Reserve, Northwest Yunnan, China.

Methodology

Using ethnobotanical methods and approaches we worked closely with community and people’s participating to develop a community based Sacred Nature Sites conservation system for biodiversity conservation. Specific technical methods included: 1) Project site selection based on the status of Sacred Nature Sites (SNS); 2) Ethnobotanical inventory; 3) Importance ranked list of SNSs at community level; 4) Participatory work plan with local community; 5) Facility with local community for project activities implementation; 6) Monitoring and evaluation; 7) Capacity building on traditional culture and biodiversity conservation.

Results and Discussion

Sacred Natural Site management patterns in Kegong village and Zuida village

Sacred Natural Sites

General SNS are called “Zeda” and “Laini” for village level SNS in Tibetan language. There are three SNSs in Kegong village, one of regional SNS and two of village SNS. There are 1300ha community level and 2000ha village level SNS surround Kegong village. Over the course of centuries, local people have been protecting these sacred sites with special care and thus protecting and promoting sacred birds and animals, sacred plants and trees and associated landforms. Baima Snow Mountain State Natural Reserve is home to more than thousand plant species., many of which are endemic. This high degree of diversity of life forms in sacred sites could be explained by the fact that sacred sites are places of origin of certain families or clans, and have been protected because many of these species are believed to be their ancestors, such as local villagers’ belief that the Golden Monkey is their ancestors in these SNS. There are 2000 ha regional level SNS is called “rinibowoduji” in local language and 1000 ha village level SNS called “dujiou” surround Zuida village.

Conservation Status

Local people have a long tradition of conservation of SNS. These SNS include diverse ecosystems, from coniferous forests, mixed broadleaved evergreen, and deciduous forests to pastures, meadows at high altitude, and agricultural ecosystems. Collecting of wild mushroom and medicinal plants is done by all households in forest ecosystems in the area. Until now, local people have participated in pilgrimages in regional SNS every year and in village SNS every day. However, these SNS are under some pressure from pilgrimage fires, management power, pollution, non-timber forest product (NTFP) harvesting etc. Some wild species are becoming endangered and rare due to over-harvesting and related local economic development. The devout attitude of local people to sacred places and both their inability (unwillingness) to destroy the inherent harmony of these places, has created optimal conditions for the conservation of biodiversity. Sacred sites are the cornerstone of their cultures, worldviews and native philosophies, not mere conservation activities. The efforts of local peoples to protect biodiversity and to preserve their cultures are interconnected and inseparable. Rare species of flora and fauna exist today by virtue of their special place in traditional cultures and their protection and regeneration within sacred sites. However, local villagers face livelihood pressures for economic development, fuelwood, wood for house construction, etc.

Conservation activities in Kegong and Zuida villages

Capacity building on understanding and cognition on conservation SNS concept and methodologies.

These include: 1) Training workshop on ‘Ethnic Culture and Nature Conservation’ organized in September, 2005 in Chuxiong City of Yunnan Province, during which 30 protected area staff, site villagers and religions professionals were trained by 8 experts from different organizations; 2)

Workshop on “Ethnic traditional culture and biodiversity conservation in Northwest Yunnan, China” held in Lijinag City in August 2006; 3) Organization of a workshop on SNS and biodiversity conservation at the local level in Nov. 14-15, 2007 in the project area.

Establishment of demonstration sites for SNS conservation in buffer area of Baima Snow Mountain National Nature Reserve

Specific activities included: 1) Establishment of community organization on “Tibetan culture and nature conservation” with 16 members of the two demonstration villages; 2) Development of village regulations on sacred natural sites and community participatory management; 3) Support for construction of 9 platforms for incense burning in the sacred forest mountains in order to avoid forest fire during pilgrimages activities; 4) Support to community for developing regulations on mushroom and medicinal plant harvesting and trading at the village level; 5) Building of a small market for mushroom trade at the community level for equity benefits and monitoring regulation implementation; 6) Support for construction of two bulletin boards in village sites for announcement of regulation and monitoring.

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ACCESS TO FOREST RESOURCES, TRADITIONAL FOREST-RELATED KNOWLEDGE AND LIVELIHOOD OF MOUNTAIN VILLAGERS: CASES IN KOREA

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Depopulation in rural areas in South Korea has been observed for the last three decades as the country has become industrialized and urbanized. The remote villages located on mountain slopes suffered most from depopulation. There are some villages in mountainous areas where people have stay in their home or returned. The reasons of their stay or return may be explained in relation to utilization of forest resources around the villages. A popular hypothesis is that greater their income, the greater likelihood that people stay or return to mountain villages.

It is expected that there would be more opportunities for the mountain villagers to earn their income from forests if there are enough forest lands accessible to them or if tourists are visiting their villages. The value of forest resources can be increased if they acquire knowledge which adds value or capitalizes on cultural services associated with the forest resources. A hypothesis is proposed to explain why people decide to live in mountain villages in Korea: if there are more forest resources or cultural heritages maintained in the village, the likelihood of villagers to stay in mountain villages increases.

The mountain areas of South Korea were surveyed in 2003 by the author in collaboration with researchers from the Korea Forest Research Institute. The above-stated hypothesis was tested with the data collected from Gangwon-do Province. The data shows that there is a positive correlation between number of households utilizing forest resources and amount of forest resources measured by area, but little impact of forest resources on the average household income in the Province. (See Figures 1, 2) There was a week relationship between the number of tourism sites such as national parks or recreational forests and average household income observed (correlation coefficient -0.5). (See Figure 3) These indicate that mere existence of forest resources and cultural services does not guarantee residents' income to be increased. There may be other conditions that are necessary before forest resources or tourism development projects can contribute to the livelihood of local people. One of such conditions is their right to access forest resources, while the marketing capacity of products and cultural services is another.

There are many non-timber forest products being collected by mountain villagers in South Korea. Among them native honey and maple sap are on high demand from consumers who concern food safety. There are customary laws still actively working in rural society where the right to access forest resources are restricted to those who have resided there for a long enough time.

A case is found in the Seoul National University Forest area in Gwang-yang City where maple sap drinking is a spring cultural activity. The culture of maple sap drinking and tapping is based on the traditional knowledge of fishermen who believe drinking maple sap help their health. The fishermen's culture has spread to urban people nowadays and created a new market for maple sap in Korea. The Seoul National University (SNU) contracts with the mountain residents who are collecting maple sap from the trees in SNU's forests and the forest is protected by the local community in return. The university has a research program to improve the maple sap production efficiency for the benefit of the local community near the SNU forests. This is an example in which traditional knowledge and modern science work together for sustainable forest management and poverty alleviation. The mountain villagers collecting maple sap participate in this research program. The household income in the village collecting maple sap from SNU Forests is higher on average compared to the average in rural communities without the access right to forest resources.

Honey bee keeping has been a long tradition in Korea. Nowadays there are two groups of bee keepers in Korea: those who cultivates bees imported with scientific knowledge introduced from

abroad and another practicing native bee culture based on traditional knowledge inherited from ancestors. An interview survey on traditional knowledge on native honey bee keeping was carried out in the *Seolpee* Village where the native bees are protected by the Livestock Promotion Act. The village is surrounded by natural forests which are legally protected by the Forest Genetic Resource Conservation Act. The bee keepers should understand the sensitive nature of the bee's life and ecosystems connected to the species. But the bee keepers do not see honey bee keeping as the main income source, but a complementary one for extra income. The main constraint against further income generation from forest resources utilization including bee keeping is lack of marketing channels and limited accessibility to forest resources. The residents of *Seolpee* Village wish to attract more customers visiting their village for eco-tourism with open access to the protected forest, which is not allowed under the forest conservation law.

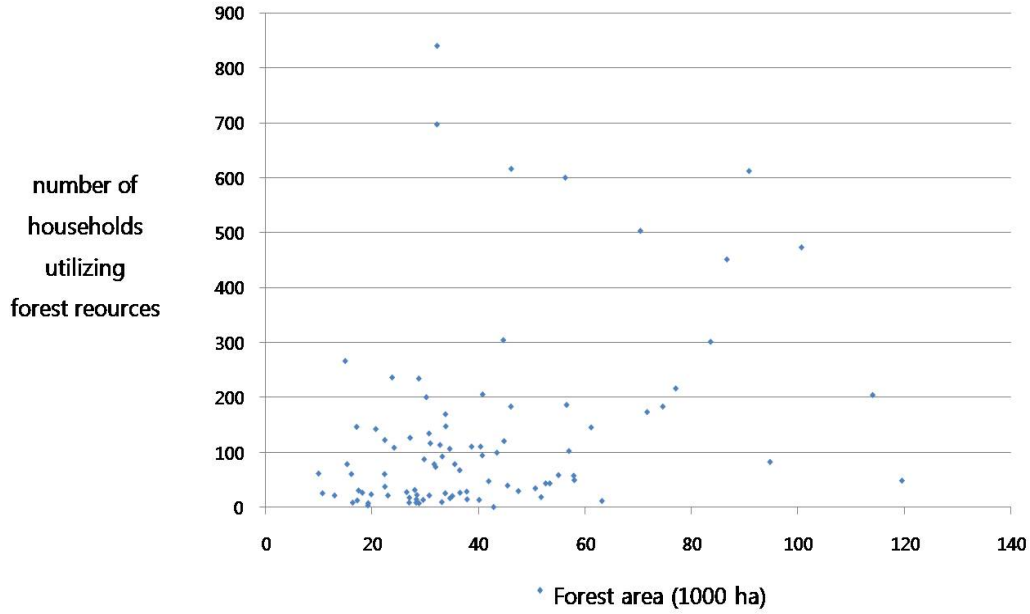

Figure 1. Number of houselholds utilizing forest resources and acreage of forest land in Korean mountainous districts

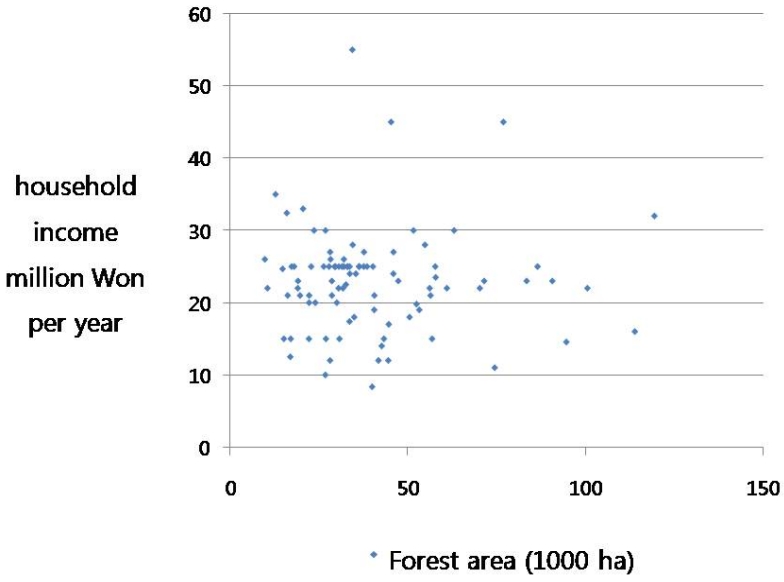

Figure 2. Annual houselhold income and acreage of forest land in Korean mountainous districts

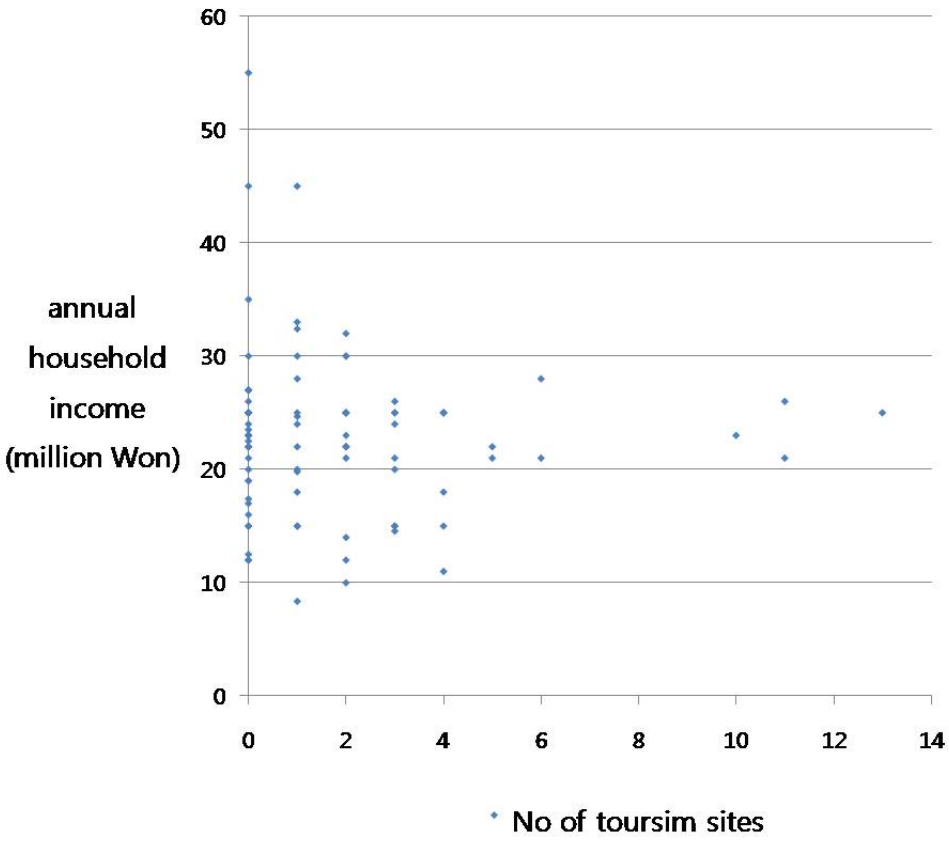

Figure 3. Annual houselhold income and number of national parks and tourism sites developed in Korean mountainous districts