

International Agroforestry Education Conference

Integrating Conservation in the Upland Agriculture in Southeast Asia

24-26 October 2007, Chiang Mai, Thailand



Book of Abstracts

**International Agroforestry
Education Conference**

**Integrating Conservation
in the Upland Agriculture
in Southeast Asia**

24-26 October 2007, Chiang Mai, Thailand

Organized by
Southeast Asian Network for Agroforestry Education (SEANAFE)
Chiang Mai University (CMU), Thailand
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The Uplands Program

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Book of Abstracts

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Foreword

This publication is a compilation of abstracts for presentation during the International Agroforestry Education Conference: *Integrating Conservation in the Upland Agriculture in Southeast Asia* held in Chiang Mai city, Thailand from 24 to 26 October 2007. The overall objective of the conference is to examine how landscapes in Southeast Asia's uplands are changing and how higher education institutions are responding to this change.

The abstracts are organized according to the three session themes of the conference:

1. Striking a Balance between Food Security and Environmental Conservation;
2. Making More Sense of Past and Present Programs and Policies in Upland Development; and
3. Redefining the Niche of Tertiary Learning Institutions in Agroforestry and Natural Resource Education for Upland Development.

The abstracts all focus on Southeast Asia and cover a range of project experiences and observations. The authors come from various government and private academic institutions, and research and development organizations both within and outside the Southeast Asian region.

The Conference Organizing Committee is grateful to the authors for sharing their project experiences so that the delegate's knowledge and understanding on the conference themes, especially on agroforestry education, can be enriched. The Committee also expresses its appreciation to the following individuals and organizations for making this publication possible:

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The Conference Organizing Committee:
Southeast Asian network for Agroforestry Education (SEANAFE)
Chiang Mai University (CMU)

Session 1

Striking a Balance between Food Security and Environmental Conservation

Paper and Poster

Striking a balance between food security and environmental conservation in the SEA uplands

Virgilio T. Villancio

FAO-RAP

With the growing population and the increasing needs for food, feeds, fiber, fuel and other human necessities, land conversion from its natural state to domesticated landscape has increased resulting to frequent occurrence of natural disasters such as floods, drought, and landslides as well as loss of biodiversity, pollution and other associated problems. This paper presents some cases focusing on the conflict, convergence, and complementation between food security and environmental conservation. It also highlights the strategies and approaches used in Southeast Asia to include plot level technologies, community-based approaches, institutional innovations and other efforts. Emphasis is also given to the current developments in biofuel, nutraceuticals, and other non-food but essential products. These include discussions on the current criticism on the loss of agricultural and forest lands to biofuel initiatives to produce biodiesel and ethanol (i.e., conversion of large tract of lands to palm oil, sugar cane and corn), thus sacrificing food security and environmental conservation. With this, the role of agroforestry is highlighted including the need to go beyond farm level approaches to landscape level and from production to enterprise and market development.

Balancing food security and environmental conservation in the uplands: Vietnamese experience

Le Quoc Doanh and Ha Dinh Tuan

Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI)

More than 80% of Vietnam's population lives in the countryside, with 70% of the labor force engaged in agriculture. In recent years, Vietnamese agriculture achieved a dramatic leap in food production, making Vietnam among the three biggest rice exporters in the world. Food security has been achieved at a national level but not at a household level, particularly in the uplands. There are real threats to food security such as a rapid reduction in per capita agricultural land, land degradation, depletion of natural resources, and subsequent increases in natural calamities.

For the uplands, food production should be linked with the protection of natural resources and the environment. Research and the transfer of intensive and sustainable farming techniques to mountainous regions have received considerable attention from different institutions. In this context, the Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI) has been involved in numerous projects related to food security and environmental protection. These include: a) Science and Technology Research Program to serve Agricultural Development in the Northern Mountainous Regions and Central Highlands of Vietnam; b) Vietnam Agro-forestry Capacity Building (VACB); c) Southeast Asia Network for Agroforestry Education (SEANAFE); and d) Project for Mountainous Agricultural Systems in the Mountainous Regions of North Vietnam (SAM Project and the research and production of safe tea products). As a result, good agricultural practices have been developed and transferred to production, resulting in a 7.0% annual increase in rice production in the last two decades. The yields of other crops have also rapidly increased. Consequently, the living standards of the mountainous farmers and natural resources have been improved. Forest coverage increased from 27.8% in 1990 to 37.5% in 2005, resulting in significant improvement of other natural resources and biodiversity. Priority has been given to development and the transfer of comprehensive solutions aimed at achieving both economic efficiency and environmental sustainability.

This paper presents the main activities and results in the struggle to achieve food security, while improving natural resources and protecting the environment, in the uplands of Vietnam.

Tourism and transformations in Banaue, Ifugao, Philippines: A case study of upland agriculture in transition

Pamela Crosby

MSc in Geography Candidate, Department of Geography,
University of the Philippines Diliman

This paper explores the implications of ongoing land conversion in Banaue, Ifugao, site of the Banaue Rice Terraces of the Philippines, to food security and the environment in this municipality. Just six years after it was inscribed a World Heritage Site in 1995, the 'Rice Terraces of the Philippines Cordilleras' was declared a World Heritage in Danger due to the gradual deterioration and diminishing number of rice terraces. Rapid urbanization, due to a growing tourism industry in the area, has significantly contributed to the conversion of rice terraces into built areas within the municipality.

Population growth, coupled with diminishing rice lands, is starting to exert pressure on the food supply of this once subsistence municipality. Banaue now depends on commercial rice and other produce from nearby towns, since yields from its own terraces alone cannot support its population. To compensate for declining rice production, some residents are now encroaching into remaining forest areas, which are increasingly cleared for swidden farms of vegetable and root crops. While rice terraces are rapidly giving way to non-agricultural uses, crop production areas are also expanding.

Agricultural and forest land conversion, and agricultural expansion due to population increase, have significant environmental repercussions. Rice terraces, which have become residential and commercial areas, are now experiencing mass wasting while new crop patches are prone to erosion and land slide. In addition, a decrease in forest area has now affected water availability in the municipality, particularly during dry seasons, and this has an impact on rice production. Farmers are experiencing delayed planting seasons due to water scarcity since local watersheds are the only available water source.

Banaue is facing the challenge of conserving its remaining rice fields and forest cover, and ensuring its population has an adequate food supply. This paper looks at how residents negotiate these two trajectories, especially now that the municipality is rapidly commercializing because of a booming tourism industry.

Forest conservation through greenhouse agriculture by ethnic minority farmers in Northern Thailand

Aer Sirijinda¹, Suwanna Praneetvatakul¹ and Pepijn Schreinemachers²

¹ Department of Agricultural and Resource Economics, Faculty of Economics,
Kasetsart University

² Institute of Land Use Economics in the Tropics and Subtropics (490d),
University of Hohenheim

In Thailand, ethnic minority farmers are often located in mountainous areas that are part of national parks. The Thai government allows farmers to live in national park areas, but at the same time, restricts their expansion into the forest. Continuous population growth has placed increased pressure on the forest.

One way to relieve this pressure would be to intensify the agriculture of ethnic minority farmers so that they could attain a higher income without having to expand their farm area. In the last decade, Thai farmers in upland areas of northern Thailand have rapidly adopted greenhouse agriculture. Adoption of greenhouses by ethnic minority farmers in the uplands has so far been limited. This paper hypothesizes that if ethnic minority farmers in the uplands adopted greenhouse agriculture, this could relieve pressure on the forest.

The paper tests this hypothesis with data from the Mae Sa watershed, Chang Mai province. The watershed includes both Thai and Hmong farmers. Thai farmers adopted greenhouse agriculture more than seven years ago, but Hmong farmers have only recently started to adopt it. Primary data was collected for 271 randomly selected farm households from September to November 2006. Data was analyzed using descriptive statistics. The hypothesis was tested by comparing costs and benefits of greenhouse agriculture and comparing these to other on-farm enterprises.

The analyses shows that greenhouse agriculture (sweet pepper) is generally profitable, giving a profit of above 350,000 Thai Baht per hectare on average. By comparison, the most profitable crop grown by Hmong farmers is roses. These provide an average profit of around 200,000 Thai Baht per hectare. There are several constraints to Hmong farmers exploiting this opportunity, including: insecure land rights; limited credit; lack of skill in greenhouse agriculture production; and access to contract market channels. Policy options available to the government are to provide Hmong farmers with credit, secure land titles, training and access to markets, while farmers could give up some of their land to the forest. The conditions for such deal require further research.

Economic performance of composite swiddening in Tat Hamlet

**Nguyen Dinh Tien, Nguyen Thi Hai Ninh, Pham Thanh Lan,
Stephen J. Leisz**

Center for Agricultural Research and Ecological Studies (CARES)
Hanoi Agricultural University

The analysis of economic performance of composite swiddening is indispensable for developing a full understanding of the functioning of this farming system in Tat hamlet. This paper provides an overview of agricultural production in Tat hamlet. It also looks at the economic efficiency of land, labor, and capital use in farming activities among four groups of households employing different farming systems. The four farming systems are (1) rice swiddens with no paddy fields, (2) mixed farming, raising livestock, and non-farm activities with no rice swiddens or paddy fields, (3) modified composite swidden agriculture with paddy fields but no rice swiddens, and (4) true composite swiddening with both rice swiddens and paddy fields. In this analysis we seek to identify which of the groups display the greatest efficiency in their agricultural production.

The analyses indicate that each group has a different livelihood strategy. While the net income from crop production of households in group 1 and 2 generated less income, the gross margins for pigs and chicken of these households gained higher income and more efficiency than other groups. The productivity of swidden rice is found to be just over-seventh of that of paddy rice. Swidden rice achieved a gross margin of only 1.224 million VND/ha (one-fifth of the gross margin of paddy), and the gross value to labor of swidden rice was only 12,500 VND/day (less than two-thirds that of paddy). The role of swidden rice is still important to those who practice it, however, because of limited amounts of paddy land in Tat hamlet.

Integrating tree crops, annual crops and natural rubber in an avenue cropping system: A sustainable soil-conserving and poverty-alleviating agroforestry model in the Philippine uplands

Carlito R. Solera, Ph.D.

Professor of Agroforestry and Manager,
University Rubber and Cacao Research and Development
Don Mariano Marcos Memorial State University, Bacnotan, La Union

This paper highlights the integration of tree crops, annual crops and natural rubber (*Hevea brasiliensis*) in an Avenue Cropping System (ACS) as a soil-conserving and poverty-alleviating agroforestry technology in the uplands.

In this system rubber trees are planted at a distance of 2m x 3m x 21m. This means that on both sides of the 21-meter wide alley, two rows of rubber trees are planted along the contour line at a spacing of 2m x 3m. Fruit crops (lanzones, durian, and coconut), food crops and annual crops (banana, corn, and pineapple) are planted in the 21-meter wide alley.

The Avenue Cropping System is an offshoot of the Rubber-based Cropping System (RbCS). It utilizes farmland to its maximum through carefully planned and designed cropping systems, with rubber as the dominant tree crop. The RCS showed that a minimum population of 416 rubber trees per hectare (4m x 6m spacing) planted together with other fruit, root, and cereal crops could be tapped beginning on the sixth year. The growth and yield performance of these rubber trees was comparable to those planted monoculture. After the first year of RbCS trial on a one -hectare farm in North Cotabato (2001-2002), the gross income from the intercropped crops was as follows: cereals - Php 24,500.00; banana - Php 25,000.00; livestock - Php 21,000.00.

These figures drop markedly after the sixth year when the rubber canopy closes, minimizing sunlight on large portions of the plantation floor and, in turn, reducing the area for intercropped crops and livestock. To promote sustainable income from intercropped crops and livestock, the Avenue Cropping System (ACS) was developed with rubber trees planted much farther apart than in the RbCS. There are now three six-year-old one-hectare ACS trials in Carmen, Makilala, and Kabacan, North Cotabato.

More small-hold farmers tend to adopt the ACS because it leaves permanent space for raising food crops and animals, minimizes soil nutrient loss, and maximizes land income. In addition to earning Php 120,000.00/hectare/year from growing rubber, the farmer earns income from the livestock and intercropped crops as early as one year after the plantation has been established.

In conclusion, the Avenue Cropping System can sustainably increase the Filipino farmer's income and help in rehabilitating the Philippine uplands.

**Learning and earning from the forest:
Complex agroforestry, markets and community wellbeing
in the uplands of Northern Thailand**

**Jeff Rutherford¹, Jamlong Pawkham², Rick Burnette²
and Boonsak Tongdee²**

¹ Fair Earth Consulting, Co. www.fairearth.co.th

² Upland Holistic Development Project www.uhdp.org

Complex agroforestry with a high proportion of native plant species exists in widespread but little understood variety throughout the Mekong Region. In northern Thailand, the diversity that characterizes these systems may offer the potential to further many different progressive objectives: biodiversity conservation, forest landscape restoration, indigenous knowledge revitalization, food security, poverty alleviation and conflict resolution. The uplands of northern Thailand have been characterized as mosaic landscapes with plants of the forest and field combined in diverse ways. Much has been learned in the last decade about changes and trends at the landscape level, but much is left to discover about the ways complex agroforestry fits into the wider landscape. Anecdotal evidence and initial studies by participants in this project suggest that production and marketing of indigenous plants in complex agroforest systems is widespread, but many intriguing questions remain about the viability of markets for these products. For example, while domestic markets for some products appear to have declined, there are stories in the field about increasing Chinese demand. The future of the Chinese herbal medicine industry could be of particular importance to the future of complex agroforestry in the region. And similar to the situation of markets for organic foods, an initial hypothesis of this study is that commercialization of indigenous agroforest products is desirable if the production is environmentally sustainable, and that it should be furthered through strategies to develop markets at different scales.

This project studies the value chains of indigenous products of complex agroforests to understand the bottlenecks, gaps and opportunities that exist, as well as studying the sustainability of production systems in village field sites. This project will also include modest pilot projects to promote the marketing of products from complex agroforest systems.

Market mania: An examination of rapid market integration as a strategy for environmental conservation and poverty reduction

Robin Roth

Assistant Professor, Department of Geography, York University

The uplands of Southeast Asia are experiencing a dual-turn towards markets as a strategy for meeting both conservation and development goals. Conservationists are promoting certain kinds of market-based opportunities with the hope of establishing environmentally sustainable livelihood alternatives while rural farmers are independently seeking out market opportunities to help them cope with the loss of resources associated with protected area establishment.

The result of this convergence is increasing market-oriented governance in landscapes, where people's livelihoods and biodiversity are both at risk. The assumption that local people will adjust to the establishment of Protected Areas through greater integration into labor, agricultural, tourism and perhaps, in the future, ecosystem services markets - while probably not unfounded - fails to take into consideration the community and household mechanisms through which such market integration occurs. Nor does it address the uneven ways a community might experience various markets.

This paper presents preliminary findings from Northern Thailand where the author has been conducting research on the social-ecological transitions associated with park establishment. By paying attention to the role of community institutions and household decision-making in the process of market integration, the paper provides a window into the social outcomes associated with increased market activity in buffer and enclave communities and can help to inform more effective strategies for meeting conservation and livelihood goals.

Balancing smallholder income from cocoa production with environmental conservation at the Central Sulawesi (Indonesia) rainforest margin

Jan Barkmann, Yann Clough and Stefan Schwarze

Georg-August-Universität Göttingen
Collaborative Research Center “Stability of the Rainforest Margin in Indonesia”

Indonesia is a leading international cocoa producer. Within Central Sulawesi -one of the poorest provinces of Indonesia and part of the Wallacea biodiversity ‘hot-spot’- cacao agroforestry expands around Lore Lindu National Park (LLNP). The cacao area went from zero in 1979 to 17,984 ha in 2001. After a period of extensive cultivation of cacao trees, planted under primary or secondary forest trees providing shade, an intensification syndrome has recently spread. This has meant reduced shading tree cover and increasing fertilizer and pesticide application.

A survey of 289 households in 12 villages around LLNP compared extensively managed plots, (identified by ~70% canopy closure above the cacao trees, low pesticide and fertilizer use; 31% cacao agroforestry area), with more intensively managed plots (~30% canopy closure, high pesticide and fertilizer use; 69% of area). Cacao agroforestry generates twice the income (gross margin/ha) than paddy rice. Vegetable and other crops are sometimes interplanted in cacao plots; however their economic importance is very low. On average, extensive plots yielded \$347 US/ha/year, more intensive plots \$546 US/ha/year gross margin. Second order stochastic dominance analysis reveals that - because of price and yield risks - more intensive agroforestry is not generally superior. An additional revenue of \$160 US/ha/year (~\$0.39 US/kg cacao beans) is sufficient to revert to extensive, high-shading agroforestry systems.

A shading tree cover reduction from 70% to 40% reduces local species richness of terrestrial herbs by 50%, and nearly eliminates forest herbs (Steffan-Dewenter et al. 2007). Also, canopy ants and wasps substantially decline and parasitism of herbivorous insects is likely to be reduced by 50%. For extremely low and zero-shading situations, much more dramatic declines have been documented. We conclude that production of cacao at ~40% canopy closure above the cacao trees substantially improves household incomes at moderate ecological losses.

Because of the financial attractiveness of further intensification, no spontaneously stable balance between intensification and biodiversity protection exists. In view of price premiums for ‘fair trade’ organic cocoa of ~\$0.40 US/kg, there is a market-based potential for less intensive pro-biodiversity cocoa production. It may be difficult to realize this potential short term, because the locally dominating cacao varieties cater to the ecologically less sensitive high-volume chocolate market.

Development of market-links for safe/organic tea as an option for biodiversity conservation and livelihood improvement in the buffer zone of Tam Dao National Park in Northern Vietnam

**Hoang Minh Ha¹, Le Quoc Doanh², Roi Estevez¹, Nguyen van Toan²,
Ha Dinh Tuan² and Nguyen Le Thang²**

¹ ICRAF Vietnam and Swedish University of Agricultural Sciences (SLU)
Email: Hoangminhha58@hotmail.com.

² Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI)

ICRAF Vietnam, Swedish University of Agricultural Sciences (SLU), German Technical Cooperation (GTZ) and Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI) are currently developing a project to promote 'safe tea' production in the Tam Dao National Park buffer zone, northern Vietnam. Safe tea involves less chemicals and the project attempts to establish market links for safe tea products through a public-private venture. The Public-Private Partnership (3-P) approach being taken includes farming contracts for safe tea growers, linking safe tea growers with national and international certification organizations and markets, and undertaking value-added tea activities. The agroforestry and conservation farming technologies employed will be: use of shade trees; a reduction in chemicals used; and mulching. Participatory assessment methods will be used to evaluate the impact of safe tea models on the biodiversity of the Tam Dao National Park and poverty reduction among buffer zone farmers.

Tea is considered a 'comparative advantage' crop in the buffer zone of Tam Dao National Park. In the last few years, changes in the export market have forced a price decline. Farmers have intensified their tea plantations to earn a living in this new economic climate, resulting in high chemical inputs from fertilizers and pesticides. It was recently found that 20 different types of pesticides (14 of which are chemical pesticides) are being used on tea. Combined with low fertilization efficiency, this has led to several harmful effects on the tea crops and surrounding environment, in particular: residual poison has been found in the tea; there are high acidity levels (pH is less than 4); low soil fertility in the surrounding area (soil organic matter is around 1.4%); a reduction in numbers of natural enemies; and a low income for tea growers stemming from the price decline.

It is expected that at least three safe tea demonstration site models will be disseminated to all communes within the Tam Dao buffer zone. The functional mechanisms for a Private-Public Partnership at the study sites are known at the national level and a participatory impact assessment method will be adapted to the buffer zone. A case study from Thai Nguyen will also be used for teaching and extension in the field of agroforestry and conservation farming.

A simple system for extending rattan seed storage

Rick Burnette and Bob Morikawa

UHDP, Thailand

Rattans are a diverse plant group, part of the palm family, and grown and planted throughout Southeast Asia and other parts of the world. Rattans have many uses, including furniture construction, baskets, mats, rope, food, and medicine. This economic importance has resulted in the disappearance of rattan from many forested areas.

Planting of rattan to try and replace the disappearance of wild rattan is done in many countries, and rattan has been identified as one of the key components in the diverse agroforestry systems of northern Thailand. Protocols for nursery propagation have also been developed but one of the big challenges continues to be practical means of extending rattan seed viability. The seed of many rattan species typically remain viable for approximately two to four weeks.

In this study, a simple storage system was adopted from work done by Yin and Xu (2000) to extend the storage life of seed of *Calamus wailong* and *Daemonorops jenkinsiana*. Seed of both species was cleaned to remove the sarcotesta, placed in breathable netting, and then stored in a sealed container over water. The container was opened periodically to allow aeration. Seed viability was successfully extended for six months.

Can paper mulberry be the basis for a sustainable agroforestry system in Northern Laos?

**Pornsiri Suebpongsang¹, Wirachinee Tajeena², Chanhson Manythong³
and Andreas Neef²**

¹ Department of Agricultural Economics, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand; E-mail: agipsbnp@chiangmai.ac.th

² The Uplands Program - University of Hohenheim, Thailand Office, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand; E-mail: neef@uni-hohenheim.de

³ Institute of Tropical Agriculture, Kyushu University, Fukuoka, Japan. E-mail: chanhsom@hotmail.com

Paper mulberry (*Brossonetia papyrifera*) is an important non-timber forest product in northern Laos, providing opportunities for earning cash income, particularly for women. Paper mulberry (PM) is durable and has many applications. In Chiang Mai, Thailand and in Luang Prabang, Laos, paper mulberry is manufactured into a wide variety of products for the booming tourist industry.

The objective of this study was to investigate production systems, processing activities, the degree of commercialization of paper mulberry (PM) and how this crop affects rural people's livelihoods and resource management. It draws on a case study from Pha Oudom district, Bokeo province, northern Laos. PM grows naturally in secondary hillside forests, in swidden fields, fallow land and also in some lowland areas in moist environments. The study involved interviews with 45 farm households of three different ethnic minority groups (Lameth, Kh'mu, Hmong) three Lao traders in Pha Oudom, and one Thai processor in Sankampaeng district, Chiang Mai province, Thailand. A comparative study of manual and mechanical cleaning of the raw material was also included. Findings suggest that equal proportions of PM bark are collected from natural stands and plantations within the study area. Collection from natural forests is declining due to resource depletion in natural stands caused by the growing number of harvesters. As a result, PM plantations are expected to expand in the future. Although cash income from selling the bark of PM is not the major source of household income in the study area, most rural households are involved in this business. Harvesting PM is an activity which can be done when labor demand for the major crops of rice and maize is low, i.e. during the dry season.

Thai processors are the major end users of the raw material. The farmers in Pha Oudom district have no bargaining power concerning the price. Thai traders set the price according to the purchasing price of Thai paper processors, and then provide price information to the middlemen. Results from the study show that PM provides crucial income opportunities for ethnic minority groups in Laos, but there is a need for more sustainable management systems. These could include monitoring PM extraction from secondary forests, increasing the area of plantations, improving the processing method and controlling the quality.

Coping with insecurities: indigenous innovation in balancing agricultural livelihood diversification and conservation in upland-lowland landscapes of Northern Thailand

Budsara Limmirankul, Chorpaka Muangsuk and Phrek Gypmantasiri

Multiple Cropping Center, Faculty of Agriculture, Chiang Mai University
(Budsara@chiangmai.ac.th)

Research suggests that development from within will enable local communities to better cope with instability. In balancing conservation and development, market incentives could enhance the use of agro-biodiversity and sustainable farming practices. Over-reliance on certain cash crops which use resource exploitative practices can result in household food insecurity, income instability, and poverty. The challenge is for the community to integrate production with marketing in a way that promotes sustainable land use practices and biodiversity conservation in agricultural landscapes.

This paper explores how local innovation that combines social organizations and production-market integration has led to dynamic land use with conservation farming practices. It also aims to provide insights into the ways organizational social cohesion has shaped conservation and livelihood diversification.

The case study was conducted at Ban Huak, a Thai-Laos trans-border village in Phayao province of Northern Thailand. The community research approach was employed to develop common understanding on conservation-development integration in upland-lowland landscapes.

The case study showed that strong village leadership and social cohesiveness within the community was an important social asset in enabling the community to negotiate with the state authority to provide basic infrastructure support and grant land use rights for farm-based livelihood diversification.

Market access determined the selection of crop species and varieties by farmers. Sustainable land use and biodiversity were observed in a mosaic of agriculture and forest, with maize-peanut rotation dominating rainfed uplands, and rice-based cropping systems dominating irrigated lowlands. Plant diversity from home gardens and community forest contribute significantly to culinary traditions throughout the year. Enhancing biodiversity through conservation farming practices included crop-legume rotation, use of green manure in rice farming, and mulching and organic composting in cultivation of *Allium* species in rice rotation.

The community has systematically organized production groups in order to prepare collective production planning and marketing strategies. The philosophy behind formation of the groups is to better cope with price uncertainty, better resource utilization and equal benefit sharing. With increasing entrepreneurial skills, the groups have partnered with the Lao trading representatives to develop contract farming for rice, maize and peanut with Laotian farmers.

The observed variety of organization forms and social coherence bring farmers together to generate and share benefits associated with improved farming-market integration.

Local ecological knowledge of Hmong and Kh'mu people and implications for resource management in Pha Oudom, Bokeo province, Northern Laos

Chalathon Choocharoen and Andreas Neef

The Uplands Program - Hohenheim Office, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand; Tel.: +66-53-944647; Fax: +66-53-893099
E-mail addresses: choocharoen@yahoo.com, neef@uni-hohenheim.de

For decades, mountainous regions in northern Laos have been characterized by subsistence land use practices (e.g. slash-and-burn agriculture) and opium poppy production. As a response to the presumed misuse of natural resources, the Lao government has implemented resettlement programs that force highland people to relocate and pursue their agricultural practices in the mid and lowlands. As a consequence, ethnic minority farmers have to adapt to a changing agro-ecological environment which has considerable ramifications for their traditional knowledge systems.

The case study was carried out in four villages - Vieng Phatthana and Thamphakae (Hmong), and Phutho and Huay Sang (Kh'mu) - in Pha Oudom District, Bokeo Province, Laos. The objective was to explore the current knowledge and practices of relocated Hmong and Kh'mu people and to investigate ongoing adaptation processes. Key informants and randomly selected villagers were interviewed using semi-structured questionnaires. Selected Participatory Rural Appraisal (PRA) tools (e.g. mapping, transect analysis, a seasonal calendar, resource flows and groups discussion) were also employed.

Based on information collected from interviews, similarities and differences exist in current knowledge of agroforestry systems. The Kh'mu still pursue their traditional cropping systems with ever-shorter fallow periods, leading to a downward spiral of resource depletion, poverty and food insecurity. Relocated Hmong farmers, on the other hand, have adopted many new agricultural practices recommended by the government, and previously unfamiliar to them. These include rubber plantation and ginger cultivation. Embracing these new activities, Hmong farmers are increasingly incorporating modern knowledge as compared to Kh'mu farmers. In the short term, at least, this has raised the economic status of the Hmong farmers. In recent years, they have become major purchasers of scarce paddy land from their Kh'mu neighbors, many of whom have become landless laborers. In addition, the present animal husbandry practices and silvopastoral ecosystem management used by the Hmong are expressions of a harmonious integration of traditional and modern knowledge.

In conclusion, this study suggests that uniform and centralized government policies in Laos affect the agricultural practices, knowledge systems and livelihood strategies of ethnic groups differentially. The differences in adaptability and resilience of ethnic groups need to be taken into account when striving towards more sustainable resource management.

Awareness raising for soil erosion by elicitation of local (soil) knowledge

U. Schuler¹, C. Clemens², N. D.Cong² and K. Stahr³

¹The Uplands Program, University of Hohenheim – Thailand Office,
Chiang Mai University, Chiang Mai 50200, Thailand

²The Uplands Program, Vietnamese-German Center – Technical University Hanoi,
1 Dai Co Viet, Hanoi, Vietnam

³Institute of Soil Science and Land Evaluation (310), University of Hohenheim,
70593 Stuttgart, Germany

Many land use practices in mountainous regions of Southeast Asia are regarded as unsustainable. Cultivation of erosion-prone crops, such as corn, is a major cause of soil and land degradation. Soil erosion and runoff on unprotected sloping land increasingly leads to landslides and flooding in the lowlands. In many cases, the impact of soil erosion is a slow process and therefore tends to be ignored or underestimated by farmers. As long as farmers are unaware of the adverse effects of their land use practices, a change towards more sustainable land management is unlikely to occur.

Through eliciting local (soil) knowledge in a Black Thai village in Son La Province (Northwest Vietnam) it was clearly revealed that local soil knowledge can be effectively used to raise awareness about the soil erosion problem. The study area suffers from severe soil erosion; rills and furrows at mid-slope position are common during the rainy season. Huge amounts of sediments have been deposited at lower slope positions, at the bottom of the valley and in the paddy fields. Often farmers are either not aware of the problem or they assume that the negative impact on higher parts will be balanced by the accumulation of fertile sediments at lower parts.

In order to mitigate the various problems arising from soil erosion and raise awareness of more sustainable land use, local soils were first surveyed and the resulting maps used as a communication tool. The surveyed history of fertilizer demand and yield of each local soil type revealed that the general perception of soil erosion improving soils at lower elevations through alluvial sediments is valid only for one of twelve local soil units. This respective local soil unit occurs in a small and very specific area. The increasing amount of fertilizer used for all other local soils indicates continual deterioration of soil fertility. Evidence from this case study suggests that local soil types can be used to generate site-specific solutions for sustainable agriculture. Such a range of potential solutions can be used by other agricultural disciplines as a starting point for their field research.

Impact of soil erosion on the soil water balance in a karst area of Northern Thailand

**S. Wicharuck¹, U. Schuler¹, K. Stahr², L. Herrmann²
and M. Panomtaranichagul³**

¹The Uplands Program, Chiang Mai University, Chiang Mai 50200, Thailand

²Institute of Soil Science and Land Evaluation (310), Hohenheim University,
70593 Stuttgart, Germany

³Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200, Thailand

The purpose of this study is to investigate the links between soil erosion and soil water balance. The village Bor Krai in Mae Hong Son province of northern Thailand was chosen as the study area.

The study was conducted on several sites around Bor Krai, characterized by representative soil types, landscape positions, land uses and types of vegetation cover. The investigations comprised measurements of soil water content with time domain reflectometry (TDR). Soil erosion was measured with modified Gerlach troughs and with the stick method. In addition, the surface of limestone outcrops and soil profiles were observed. The land use history was obtained from villagers to estimate the long-term erosion rates. Soil types, petrography, bulk density, aeration porosity, field capacity, aggregate stability, infiltration rate, total soil water storage, pH, plant available P and K, as well as organic matter, were also determined.

The study ascertained that Luvisols, Acrisols and Cambisols are the main soil types. It also determined that parent material has an essential influence on water infiltration rates. Soils from limestone generally have higher infiltration rates than soils from claystone. The subsoils of Luvisols and Acrisols at higher elevations showed higher plant available water content than the topsoil, but the nutrient content was significantly lower. The morphology of limestone outcrops and charcoal within soil profiles indicate soil erosion rates of more than 1cm per year for vast areas.

Soil erosion has several impacts on soil water balance. In particular, it reduces the total water storage capacity of the soils. This concurs with statements of villagers that the discharges of springs have decreased in recent decades. In addition, soil erosion leads to an exposure of subsoil, often resulting in different water availability for plants. The more infertile subsoils require higher quantities of fertilizer.

Survey to determine current pruning practices of litchi (*Litchi chinensis*) growers in Northern Thailand

**Marcus Nagle¹, Kanitta Satienerakul², Winai Wiriya-Alongkorn³,
Somchai Ongprasert⁴ and Joachim Müller¹**

¹ University of Hohenheim, Agricultural Engineering,
Tropics and Subtropics Group, Germany

² Mae Jo University, Faculty of Economics, Thailand

³ Mae Jo University, Department of Horticulture, Thailand

⁴ Mae Jo University, Department of Soil Conservation, Thailand

A survey was conducted following the 2007 production season to determine the current pruning practices of Litchi growers in Chiang Mai province, Thailand. Farmers tending orchards in the Mae Rim district were selected as the focus of the study. A total of 45 growers were surveyed by individual interviews using a semi-structured questionnaire. The questionnaire was divided into four parts: general information; one part for farmers who don't prune; and two parts for farms who do prune. Farmers who do not prune were asked to provide reasons for not pruning and explain existing limitations. Farmers who do prune were asked about the importance and drawbacks of pruning, about the type and frequency of pruning, and about the amount and uses of pruning materials produced.

The study found that most farmers prune their orchards and consider it an important practice. 'Hard' pruning is generally done every one to two years using the open-center technique. This is important to form the characteristic shape of the litchi tree that facilitates production, management and harvesting. This practice is performed several weeks after harvest and produces significant amounts of wood. 'Light' pruning, which is the trimming of leaves and twigs and small branches, is done throughout the year and directly after harvest, especially when there is no hard pruning. Pruning know-how has been acquired from a variety of sources, including traditional knowledge and professional training (researchers and extension services).

Current uses of pruning materials are described as limited. Prunings such as leaves and twigs are usually left in the field and either burnt to control pests and disease or used as mulch. Farmers sometimes utilize at least part of the pruning wood, either for making charcoal or for direct burning as cooking fuel, although they were unable to state the amount of wood used. Pruning wood from litchi is rarely sold or transferred far from the field, but is considered a good fuel.

In conclusion, pruning practices of litchi farmers in Chiang Mai have been initially explored. The possibility for using pruning wood as a renewable energy source for litchi drying will be investigated as the next step.

Scale dependant biodiversity management in litchi production systems: an ecological challenge for sustainable upland agriculture in Northern Thailand

Dirk Euler¹, Konrad Martin¹, Joachim Sauerborn¹ and Vichian Hengsawad²

¹Institute for Plant Production and Agroecology in the Tropics and Subtropics, University of Hohenheim, Stuttgart-Hohenheim, Germany, deuler@uni-hohenheim.de

²Postharvest Technology Institute, Chiang Mai University, Chiang Mai, Thailand

As a consequence of increasing land pressure, sustainable agriculture in upland northern Thailand is aggravated by biodiversity loss, erosion, soil degradation, weed and pest pressure. Increasingly intensified production of litchi creates simplified agroecological communities with limited capacity to provide beneficial ecosystem services. The challenge of alternative sustainable approaches is to implement dynamic management systems at plot or farm scale and sustainable cultivated landscapes in order to conserve biodiversity and therewith ecosystem functioning. This requires knowledge on interactions between pests, beneficials and vegetation on field and landscape scale. In this study we therefore analyzed the results derived from a system inherent and multiple scale approach in a litchi production area of northern Thailand. On landscape scale, the analysis of the ground cover vegetation of 59 study plots indicates that management measures and corresponding vegetational succession as well as structure of the surrounding vegetation preconditioned by intensity of land use were the relevant factors affecting the ground cover vegetation in litchi orchards. Functional relations on landscape and field scale cannot be regarded as segregated units and need both to be considered in sustainable land use planning. The field scale results based on the specific management conditions in established subplots indicated also that large scale and simultaneously applied homogeneous treatments such as regular mowing of ground cover vegetation in orchards are insufficient to sustain a complex patch-dynamics of distinct successional stages required by beneficial insects as well as an appropriate environment to increase biodiversity. Similar to plant species composition, surrounding landscape elements play also an important role for insect populations. The recorded movement patterns on landscape scale of the beneficial and pest insects suggested that woody habitats are a crucial (re)colonization sources for both insect groups and that sustainable land use and alternative pest control can only be attained, if the relationships between field management, attendant vegetation, inhabiting pest and beneficial insects as well as landscape structure and fragmentation are considered. Comprehensive multi-scale and multi-species based strategies need to be developed to maximize pest control, while maintaining suitable on-field habitats for beneficials and woodlands as recolonization sources and natural elements for biodiversity conservation.

Modeling erosion and runoff with WaNuLCAS 3.2: The dataset Ban Tat, Northern Vietnam

Lippe, M.¹, Dung, N.V.², Vien, T.D.², Kien, T.T.², Hilger, T.¹, Cadisch, G.¹

¹ Insitute of Plant Production and Agroecology in the Tropics and Subtropics
University of Hohenheim, Germany

² Centre for Agriculture and Ecological Studies (CARES)
Hanoi Agricultural University, Vietnam

Demographic pressure and increasing economic development are the driving forces for an intensification of agricultural production and the formation of fragmented landscapes in Vietnam. Especially, mountainous areas faced rapid changes in land use systems and became prone to environmental degradation and resource overuse in the past decades. Furthermore, slash and burn agriculture is still applied in many upland areas. Government efforts to stop these methods were not successful and adoption of local environmentally appropriate techniques did not spread in many areas.

The Centre for Agriculture and Ecological Studies (CARES) of the Hanoi Agricultural University carried out a long-term nutrient balance analysis of selected local cropping systems in Ban Tat, Hoabinh Province, Northern Vietnam. The analyzed cropping system patterns represent combinations of upland rice, cassava and improved fallow with *Melia azedarach* or *Styrax tonkinensis*. On plot erosion measurements were undertaken to understand the nutrient flows from upland swidden fields into lowland paddy areas within a small watershed of the Ban Tat area. The assessment of long-term effects of such systems is often difficult to predict. Therefore, the objective of this study was to test the applicability of the Water, Nutrient, Light Capture in Agroforestry Systems (WaNuLCAS) model related to erosion under the conditions of Ban Tat. Results of field measurements and information based on farmer interviews were used to calibrate the model. A selected set of input parameters from the area regarding agricultural management, climate, soil structure and topography were used for sensitivity analysis and to define threshold values for the model calibration. Different scenarios of the CARES experiments served for model validation, representing the experimental setup related to the local swidden practices. In conclusion, WaNuLCAS 3.2 can serve as useful tool for an ex-ante testing of new crop management methods within a selected setup of parameters. Model applications, however can help to understand the behavior of a defined system, but should not be taken as authoritative statement per se.

Ethical small-scale agricultural business approaches to foster landscape level conservation and biodiversity protection: A case study from Xishuangbanna, South- Western China

Julia Schmitt and Volker Hoffmann

University of Hohenheim Institute for Social Sciences of the Agricultural Sector (430a)

The tropical mountains of Xishuangbanna, along the Upper Mekong River, are considered by UNESCO as global biodiversity hotspot and the oldest and most famous Puer-tea growing areas in the World. The tea trees *Camellia sinensis* grow in the under-storey of the mountain rain forest, providing the habitat for rare epiphytes, orchids, and a number of non-wood forests products. They are an essential part of the livelihood of ethnic minorities living in and near the forest.

A wealth of indigenous knowledge on managing these tea forests and process the leaves into a highly priced product exists among the mountain dwellers. However, this unique and sustainable land use management system is fragile and the increasing demand for tea increases the pressure to convert traditional, diverse tea forests into tea tree monoculture plantations.

Ethical small-scale agricultural businesses like the Bulangshan Heritage Project intend to restore the traditional management system and to develop high valued certified and branded products. The expected premium return will justify the low extensive traditional tea management and provide incentives for communities to maintain their semi-natural eco-systems. The Bulangshan Heritage Project was created by the Research and Development Centre Tian Zi and is scientifically supported by Hohenheim University, Germany.

To create and sell high quality, premium priced products, certification schemes like Fair Trade and organic certification schemes are obligatory. The technical capacity required for establishing, managing and monitoring certification systems are, however, not locally available and the costs cannot be totally covered from the premium the product can fetch at the International or the Chinese upper market segments in Beijing, Shanghai or Hong Kong.

Therefore, additional ecosystem marketing approaches are assessed that can contribute to provide incentives to ethical small-scale agricultural businesses to invest in integrated forest protection and management approaches.

The poster highlights the status and challenges of the certification activities under the Bulangshan Heritage Project. Furthermore, it presents selected results from a Puer-tea value chain study. Conclusions highlighting the education demand at the different levels and the necessity to develop partnerships between education institutions and small-scale agricultural businesses are also included.

The Integrated Soil and Water Conservation for Sustainable Rainfed Multiple Cropping in Hilly Agro-Forestry System

Mattiga Panomtaranichagul¹, Karl Stahr², Sivapong Nareubal³

¹Chiang Mai University, Thailand

²The University of Hohenheim, Germany

³Maehongson Rice Research Center, Ministry of Agriculture and Co-operative, Thailand

The 3 year - field trial was carried out to evaluate the effects of integrated anti-erosive cultural practices on sustainable rainfed highland crop production in Northern Thailand during January 2004 – March 2007. The 2 main experimental plots were selected from the 3 farmer's fields in the 2 basins (Sites A and B), at hill slope of 80% and 40% respectively. Each main plot consisted of 12 sub plots (5 x 30 m) with rotations of the three annual multiple crops, sweet corn, upland rice and lablab bean. The mixed species of fruit trees (Mango, Lemon, and Jujube) and leguminous ground cover crop (Graham Stylo) were grown in the hedge rows of alley cropping treatments. The experiment was a completely randomized design with three replicates of 4 anti erosive treatments: (i) Conventional contour planting (CP), (ii) Contour furrow cultivation and alley cropping (CF -AL), (iii) Contour furrow cultivation with surface mulching of Imperata grass panel in Site A and Bamboo trunk panel in Site B, with the alley cropping (CF-M-AL), and (iv) Conventional contour planting and alley cropping with additional Vetiver grass rows next to the fruit- tree hedgerows (CP -AL-VG). This paper aims to present the 3 year results of runoff, soil loss, soil water storages and crop water use efficiency under different soil and water conservation techniques obtained during 2004-2007.

The results showed similar trends during the 3 year trials as follows: (i) The highest total amount of runoff, soil loss and the lowest soil water storage occurred in CP plot, whilst the least runoff, soil loss and the highest stored soil water were found in CF-M-AL plot, compared to either CF-AL or CP-AL-VG plot. (ii) CF-AL, CF-M-AL and CP-AL-VG gave similar amounts of total dry matter and yields of sweet corn which were significantly higher than those given by CP during the wet season. The lowest and the highest dry matter and yields production of lablab bean were obtained under CP and CF-M-AL respectively, compared to either CF-AL or CP-AL-VG in both Site A and Site B. (iii) CF-M-AL tended to give the highest while CP gave the lowest dry matter, yields and water use efficiencies of both corn and lablab bean, compared to either CF-AL or CP-AL-VG during the three experimental years. In general, the most effective cultural practice to improve sustainable rainfed hill farming appear to be composite systems, consisting of contour furrow cultivation with mulching in alley cropping, with hedgerows of mixed fruit trees and leguminous ground cover crops. The increased multiple cropping productivity will encourage the highland stakeholders to adopt the Furrow-Mulching in Alley Cropping technique as a sustainable highland agricultural practice.

Steps and Methods for the Identification of Potential Land-Use units in the San Patong Land Reform Area Chiang Mai Province, Northern Thailand

Dr. Harld Kirsch

German Development Service (DED), Phnom Penh, Cambodia

Potential land-use units were defined for a land reform area in Northern Thailand within a joint project on *Improvement of Crop Yields and Simultaneous Environmental Impact Assessment in Conjunction with Intensification and Diversification of Agroforestry on Marginal Land in Northern Thailand*. This project was carried out by three academic institutions from Germany, Netherlands and Thailand in 1992 – 1995.

Since 1986, a total number of 2400 plots of land were distributed by Land Reform Department to 1960 poor, landless farmers and their families. Previously the project area was covered by degraded dry deciduous forest and grassland.

After a stepwise integration of physical and socio-economic data, all land use potentials and constraints were analyzed to explain land use changes that occurred during the project period, and to suggest potential future types of land utilization. Besides economical constraints, the soil quality and access to water proved to be the main factors. The data sources used were field surveys results, aerial photos, satellite images, and topographical maps of various scales. Additional information came from laboratory analysis of soil and water samples, socio-economic studies conducted by students of Chiang Mai University, and participation of local farmers.

Since the physical conditions defining the land suitability in the study area are very similar to many areas in Cambodia, conclusions for a process leading from land resource assessment (LRA) to a land suitability evaluation in this country can be drawn. Land suitability evaluation is supposed to support Participatory Land Use Planning (PLUP) in Cambodia.

Any land use planning should strongly consider suitability aspects based on physical and social conditions. Improvement of soil fertility and water supply can increase the suitability. Simple technologies have to be preferred.

Cooperation between independent academic institutions, government departments, and the rural population can be very fruitful for all sides, e.g. in the sector of agricultural extension and diversification of crops. However, success depends on the capacity of universities, etc. and the cooperative attitude of government officials.

Session 2

Making More Sense of Past and Present Agroforestry and Natural Resource Management Policies and Programs in Southeast Asia

Paper and Poster

Learning from failures and successes of policies and projects towards integrated watershed management in Southeast Asian uplands

Andreas Neef

The Uplands Program - University of Hohenheim, Thailand Office, Faculty of Agriculture,
Chiang Mai University, Chiang Mai 50200, Thailand; E-mail: neef@uni-hohenheim.de

This paper attempts to identify the major factors associated with some of the failures and successes of integrated watershed management policies and projects with a particular emphasis on the uplands of mainland Southeast Asia. It sets out by describing the uncertainties of knowledge under which upland watersheds are managed and the strategic simplifications that characterize government policies and project agendas. The paper argues that many policy measures have been misguided by (1) failing to acknowledge the multi-functional character of mountain watersheds, (2) putting too much emphasis on one-size-fits-all conservation models, technology-driven solutions and command-and-control approaches, and (3) neglecting the various institutional dimensions of resource conservation and integrated watershed management. The latter is particularly evident in the failure of most Southeast Asian governments to legally recognize communal forms of resource tenure and to monitor more closely the differential impacts of private and state property regimes and of enhanced market integration on resource conservation and adoption of sustainable and less sustainable agricultural practices in the uplands.

Co-management approaches to natural resource conservation or multi-stakeholder platforms in combination with Payment for Environmental Services (PES) schemes have been widely proposed to break the deadlock in upland conservation policies, and pilot projects in Indonesia and the Philippines have shown encouraging results at some locations. Yet, they still have to prove their viability on a broader scale and their swift implementation seems to be unrealistic in countries such as Thailand and Lao PDR where both tenure security and political participation of upland people are weak and skepticism of lowland dwellers and policy-makers towards ethnic minorities' capacities to manage upland resources in a sustainable way remains strong.

International highland projects - while using the common development rhetoric of participation and sustainability - have mostly failed to induce meaningful social empowerment of marginalized highlanders and to foster multi-stakeholder partnerships and more sustainable resource management practices beyond the projects' borders and duration. Successes were possible where project staff and government officials showed a long-term commitment to social and institutional change and where the focus was primarily on people's livelihoods and adaptive capacities rather than on commodities and fixed technological packages.

The paper concludes that future policies and approaches towards integrated watershed management need to overcome the (perceived) antagonism between conservation and development in upland areas of Southeast Asia and to determine the socially, institutionally and ecologically optimal mix of agricultural production, ecological services and rural livelihood opportunities.

Experience and lessons learned from rewarding environmental services

Somchai Tasingsa

Natural Resources and Environmental Management Division.
Office of Natural Resources and Environmental Policy and Planning,
Ministry of Natural Resources and Environment, Thailand

First of all, I would say that it is a great honor to be given the opportunity to speak here today. I must thank you for inviting me.

In speaking as a representative of the Secretary-General of the Office of Natural Resources and Environment Policy and Planning (ONEP), I would like to share our experience in learning opportunities and implementation related to today's subject, as well as some of the essential policies of ONEP that are in accordance with speeches of Their Majesties the King and Queen. I hope that my sharing will benefit the session and encourage progressive ideas and comments.

Today, many current problems and situations around the globe are having relatively serious impacts on both humans and the earth itself. Consequences of harmful human actions are following from their destruction of nature. Yet at the same time, nations around the world are struggling to reduce poverty, inequity and human suffering, as reflected in efforts to achieve Millennium Development Goals. Active participation integrating both thought and action needs to be taken in order to improve equity, and to save our environment for the long-term benefit of individuals, nations and our planet.

Let's talk about agroforestry in Thailand.

Actually, Thailand has been familiar with various types of agroforestry practices for a long time. Traditional agricultural practices in the different regions of the country have included various forms of mixed agriculture, orchards and gardens that have included interplanting of a diverse range of tree species yielding products useful for local people and for sale in commercial markets. Some, such as *miang* tea gardens, have even been based on interplanting tree crops into natural forests. Foresters and forestry agencies in Thailand have also tested and promoted various agroforestry practices using forest tree species aimed at helping establish small to large-scale plantations, as well as for household or community woodlots to provide essential wood or non-timber forest products for subsistence or commercial needs.

More recently, broader agroforestry approaches have emerged at international levels, including landscape agroforestry concepts. Focus on broader agroforestry landscapes helps improve understanding of interactions among agriculture, forests, and environmental services such as water, biodiversity, carbon stocks, etc.

Initial application of landscape-level agroforestry concepts in Thailand has been in the mountainous Northern region. This region is seen as especially important for providing environmental services in the forms of water and biodiversity. Yet during recent decades, many forest trees have been cleared, which is believed to have brought ecosystem disequilibrium that has increased severe flooding, mudslides, and other natural disasters. Agroforestry concepts and practices have helped address some of these problems to a certain extent by improving land use practices in parts of landscapes that are especially important in relation to preventing natural disasters. More-

over, agroforestry practices and landscape management can bring benefits to local people by helping them earn more, while at the same time helping conserve ecosystem equilibrium needed to protect against mudslides, preserve biodiversity, provide good stream flow, and so on.

Issues related to environmental services and rural poverty have also been important in Thailand for a long time. Their Majesties the King and Queen have been very concerned about soil, water, forest and the environment, as reflected in the emphasis these issues have received in their speeches. For example, in his birthday speeches, His Majesty the King has advocated reforestation and forest conservation as dual means to ensure a steady supply of water for consumption and cultivation. If we fail to maintain the highland forest, we will have problems ranging from soil erosion to sedimentation in dams and in rivers, which can lead to floods. And on the occasion of her 75th birthday, Her Majesty the Queen expressed concern over unchecked deforestation which could lead to shortage of fresh water in the near future. Her Majesty the Queen urged the government and the public to help preserve existing forests and promote new forest plantations, so that people will not suffer from droughts in the near future.

At the same time, Their Majesties have long supported development projects for poor communities in mountain areas. These include pioneering efforts under the Royal Project Foundation to bring improved economically viable livelihoods to remote highland areas, as well as demonstration of sustainable development activities in Royal Development Studies Centers, and thousands of other Royally-Initiated projects aimed at improving livelihoods and quality of life in poor villages throughout the country. During recent years, these initiatives have been increasing their emphasis on assuring sustainability and protection of important environmental services.

The Ministry of Natural Resources and Environment was established in 2002 in recognition that rapid economic growth cannot be sustained if natural assets are not well maintained. Its mission to conserve, protect and rehabilitate natural resources and the environment are consistent with government objectives that include sustainable development and equitable growth. And in accordance with constitutional mandates for participation and involvement by the people in environmental management and conservation, the government is also seeking to delegate more responsibility to local communities, and encourage their participation in improving environmental quality.

In terms of ONEP's specific mission, we have been conducting many studies related to watersheds and environmental quality in highland areas of Chiang Rai, Nan, Chiang Mai, and the Ping River, as well as watershed classification studies. While such areas are very important for providing environmental services, we are also aware that they are home to many of the poorest and most marginalized communities in the country. Studies are also examining pollution and resource management in lowland areas, as well as ways to reduce resource demands and improve efficiencies of resource use. Linkages among natural resources, environmental services, poverty, public health, economic development, and quality of life are topics of particular concern for ONEP.

Thus, another important area of activity for ONEP has related to integrated watershed management in the Ping River Basin. In studies and pilot project work, we have been collaborating with various relevant departments and agencies in the Ministry of Natural Resources and Environment, as well as with provincial and local governments, NGOs, peoples organizations and local communities. Our efforts have focused on several key levels of organizational mechanisms that can improve participatory management of

natural resources and environmental services. This includes negotiations and collaboration among a range of important stakeholders from upstream to downstream areas, in accordance with principles of equity and covering many aspects related to quality of human life. If this can be achieved, we believe this approach could be one of the most important mechanisms in Thailand for rewarding the provision of environmental services in a sustainable manner.

Another important set of issues of concern for ONEP relates to providing appropriate incentives for efforts to improve sustainable management of natural resources and environmental services. In accordance with views of Their Majesties, the most desirable outcome is for people to achieve viable livelihoods that can reduce their negative impacts on sustainable provision of environmental services. And if multi-level participatory river basin management organizations become operational, they may be able to provide a forum for negotiation among major stakeholders that may include some form of compensation for those being asked to bear costs of activities that primarily benefit downstream or other elements of society. We are also aware that there are efforts underway elsewhere in Southeast Asia and in other parts of the world to explore and address these types of issues. We are interested in learning from results of experience elsewhere, and hope that networks such as SEANAFE may be able to help support exchange of experience among countries in the region.

In conclusion, human beings often exploit natural resources without concern for resulting negative impacts. Now that the earth is beginning to experience climate change and increasing natural disasters, human life is now facing more difficulties. Even if all concerned stakeholders pay more attention, these problems may not be fully solved due to the accumulation of previous impacts. But at least it may be possible to reduce the occurrence of severe situations.

In today's perspective, agroforestry may be one aspect of approaches that can help accomplish this. But if so, then how are we going to spread these ideas to encourage public discussion and action?

And in terms of impact mitigation, we are cooperating in efforts to address these problems through reducing core activities that may encourage deterioration of ecosystems. I can assure you that we are actively seeking appropriate ways to reward protection of nature and the environmental services it provides. This can also help mitigate critical global circumstances, leading to reduced global warming and ecosystems where many types of creatures can live together happily.

Moreover, when assessing the benefits of all forms of management, the greatest rewards returned back to us are environmental services provided by healthy cycles of nature.

And last but not least, I hope you will use the remaining time available to express your point of view, in order to exchange lessons learned and help promote creativity in efforts to improve our world.

Decentralization in forest management in Vietnam's uplands: Case study in three communities

Tran Duc Vien and Nguyen Vinh Quang

Center for Agricultural Research and Ecological Studies (CARES)
Hanoi Agricultural University

For people in the uplands of Vietnam, forests have been an important resource, contributing greatly to their livelihoods and well-being through helping them to generate income, providing subsistence goods, supplementing inputs for farming, and reducing vulnerability during times of crop failure, unemployment, and other hardships. Prior to independence, the Vietnamese Government had already initiated policies and programs on natural resources management and land use management. During the 'Doi Moi' period (from the late 1980s to now), the Vietnamese Government issued two new laws; the Law on Forest Protection and Development in 1991 and the Land Law in 1993. This is the first step in decentralizing natural resources management (NRM), or the first sign of transferring development and management responsibilities of natural resources from the central state to lower levels.

Using exploratory research and descriptive statistics, this paper provides an overview of how the decentralization process operates in forest management in three study sites. It also identifies the impacts of the decentralization policy on forest resources and local peoples' livelihoods. The research has found that the policy changes have failed to bring about better management, conservation, and development of forest resources. More specifically, the shift towards effective community-based forest management is still incomplete, while forest quality continues to decline. Local farmers who participated in the land allocation process did have a positive influence, however their participation is still limited.

Adaptation of farming systems to economic development: Agricultural commercialization of Karen hill tribes in Northern Thailand

Prasnee Tirpaqsa and Pepijn Schreinemachers

Institute of Land Use Economics in the Tropics and Subtropics (490d),
University of Hohenheim, Germany

This research project studies how Karen ethnic minority people have adapted to changing economic conditions. The study uses group interviews in conjunction with individual interviews conducted among 240 Karen households randomly selected from 12 Karen communities in Chiang Mai province. Data was analyzed using a combination of descriptive statistics and regression analysis. Results show that, contrary to widespread belief, Karen households are well integrated into markets. The average level of market integration was 20% for output markets, 32% for variable input markets, 19% for factor markets, and 45% for consumption markets. Although Karen households still predominantly rely on rice production and other minor field crops for home consumption, a large number have diversified into market-oriented crops such as tomato, bush bean, egg plant, tea, taro, groundnut, persimmon, and strawberry.

Regression analysis showed that higher levels of integration into output markets are most strongly associated with a greater gross farm output and more contacts outside their own community. Higher levels of integration in input markets are mostly associated with greater access to credit and market channels, while integration into consumption markets mostly results from more contacts outside their own community.

The results also indicate that higher levels of market integration are generally associated with greater levels of economic well-being, as measured by per capita income. Shifting towards market-oriented agriculture increases the demand for production resources, some of which are becoming scarce, such as water. The long-term economic prospects of agricultural commercialization and possible adverse ecological impacts associated with increased use of agro-chemicals are also discussed. The results have implications for Thai policy-makers who have recently put increasing emphasis on the concept of 'sufficiency economy' to promote the well-being of the people. The study suggests that the well-being of Karen farmers would be enhanced by further promoting their integration into the market economy.

The effects of protected forest areas on land use and local economic development: Evidence from north and northeast Thailand

Katharine R. Emans Sims

Sustainability Science Program, Center for International Development
Harvard University, 617-733-2039
kresims@fas.harvard.edu

In the past three decades, many countries around the globe have set aside large tracts of forest habitat with special conservation status. While this environmental protection can have benefits at the regional or global scale, such as increased water quality or biodiversity, there is concern that restrictions on land use mandated by protection may impose significant costs at the local level. This paper examines how national parks and wildlife sanctuaries in Northern Thailand have affected local land use, income, poverty, inequality, and population density at the sub-district (tambon) scale by the year 2000.

Socio-economic and land use outcomes were used, at the tambon level, for more than 1900 tambons in the North and Northeast regions of Thailand. To estimate the effects of protected areas, comparisons were made between tambons with different proportions of land in national parks or wildlife sanctuaries, but with similar pre-protection characteristics including slope, elevation, distance to major cities, distance to railroads, distance to rivers, density of water resources, historical forest cover, and province.

The findings suggest that sub-districts with high proportions of land in national parks and wildlife sanctuaries are associated with significantly higher forest cover than other similar sub-districts, suggesting meaningful enforcement of land use restrictions. Despite the increase in forest cover, sub-districts with high proportions of land in national parks actually have higher estimated incomes and lower estimated poverty headcounts than comparative sub-districts. National parks also appear to have generated positive spillovers to neighboring sub-districts in terms of forest cover and economic outcomes. Wildlife sanctuaries, however, are not associated with significant effects on incomes or poverty, and may have had negative spillover effects with regards to forest protection.

The difference in outcomes between protected area types is likely explained by the promotion of recreational tourism and associated amenities in the national parks. While this research indicates that national parks and wildlife sanctuaries in Thailand do not seem to have impoverished local sub-districts in comparison to similarly remote sub-districts, it is important to note that when compared to urban sub-districts, communities with protected areas are clearly poorer in material wealth. This highlights the development challenge common to many rural areas, with or without environmental protection.

**Designing and implementing responsive information,
education and communication strategies:
The case of sustainable agriculture and natural resources
management collaborative research support program
Southeast Asia**

**Romulo T. Aggangan¹, Vellorimo J. Suminguit, Ma. Victoria Espaldon
and Ma. Rowena R. Baltazar**

¹Forestry and Environment Research Division, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), 4030 Los Baños, Laguna, Philippines.

E-mail: r.aggangan@pcarrd.dost.gov.ph or raggangan@yahoo.com,
Tel. # 63 49 536 0014 to 536 0020, Fax # 63 49 536 0016 or 536 0132

The Sustainable Agriculture and Natural Resources Management Collaborative Research Support Program Southeast Asia (SANREM CRSP/SEA) had made significant progress in ensuring research results are packaged and disseminated to appropriate audiences. As more research outputs were delivered, the program faced the challenge of developing an innovative strategy to reach a wider and more diverse set of information users.

The program conducted activities that led to the creation of an Information, Education and Communication (IEC) strategy and strengthened capacities for environmental decision-making among communities, governments and academic institutions. The strategies implemented included launching the School on Air, Farmers' Technology Forum, calendars, training modules for agroforestry and soil and water conservation, and use of the 'warik warik' (a four wheel vehicle that travels around remote areas to sell fish and other basic goods). In this case, the warik warik was used to carry development and environmental messages. All of these strategies were used to disseminate the outputs of the program at the municipal and community levels.

A series of training sessions on Geographic Information Systems (GIS) were conducted for 61 municipal and provincial planners to enhance their capacity to plan and manage natural resources. Training modules for farmers and agriculturists, and a participatory natural resource management resource book for extension and academic institutions, were also developed.

Introducing psychological-based theory to investigate the intention to adopt agri-environmental policy: A conceptual framework

W. Bumbudsanpharoke^{1,2} and D. Moran²

¹ School of GeoSciences, University of Edinburgh, UK,

² Scottish Agricultural College, UK
wimolpat.bumbudsanpharoke@sac.ac.uk

Agricultural diffuse pollution presents an intractable problem for water quality management in river basins. Adopting Best Management Practices (BMPs) is an alternative approach aimed at protecting watersheds through moderating diffuse pollution. Although the advantages of BMPs are widely acknowledged, the question is whether farmers are voluntarily willing to engage in conservation practices. The ways in which farmers make decisions about voluntary adoption of pollution control measures are not well-understood.

This paper uses the Theory of Planned Behavior (TpB) to analyze farmers' intentions to adopt BMPs. The TpB has been used in agricultural research to examine farmers' behavioral responses to technological innovations, management techniques and changing support mechanisms¹. The TpB states that behavioral intention is determined by a combination of attitudes towards the behavior outcomes, perception of others' views towards the behavior, and the degree of control one thinks one has over a decision to carry out the behavior.

In the initial stage, open-ended questions were used to discover general opinions. Statements concerning BMPs uptake were taken from citrus growers in the Ping River basin. Content analysis was carried out to systematically identify latent messages. Behavioral intention variables which most frequently turned-up were chosen. To create robustness for the 'willingness to adopt' function, external variables of demographic, farm attribute, human capital investment², and technology choices were added. The structured questionnaire using both TpB and the external variables was developed and will be used for personal interviews.

It is hoped that the findings of this study will identify differences between strong and weak adopters, assess the relative importance of the intentions for predicted behavior, and assess the intention to adopt BMPs. As far as policy implications, the kind of integrated conceptual framework presented here is expected to overcome the relative lack of concern, amongst policy-makers, over willingness to adopt agri-environmental policy.

¹ For example, University of Reading, 2006; Zubair and Garforth, 2006; Fielding, et al, 2005, and van Gossum, et al, 2005

² Potential external variables have been reviewed. See more from Sheikh, et al, 2003, and Rahm and Huffman, 1984

Sustainable livelihoods improvement and advocacy support project: Responding to the needs of indigenous peoples in newly-awarded CADT Areas in Mt. Apo, Philippines

Mary Luz Menguita-Feranil

Executive Director of the Alternate Forum for Research in Mindanao (AFRIM) Inc.

Marginalized indigenous communities in the uplands of Mindanao have time and again been threatened by competing and overlapping claims for, and utilization of, their ancestral domains. Private capital and State interests in the vast resources in ancestral domains have resulted in conflict and division among indigenous communities. While both State and private interventions hold the promise of paving the road towards the development of ancestral domains, most members of indigenous communities now find themselves in the midst of a tug-of-war between the choice to embrace 'modernity' or uphold indigenous values and approaches toward collective action and mobilization for ancestral domain development.

Encroachment by the Philippine National Oil Company and other business interests into the ancestral domain in Mt. Apo posed more threats than opportunities for the Obo-Manobo indigenous communities. In total, the road towards modernization resulted in unrestrained exploration of energy resources, deforestation and illegal logging activities by lowlanders, all of which seriously threatened the ancestral domain and claims of indigenous communities.

While new and fresh opportunities were supposedly provided by these 'development' projects, off-farm employment, such as hired labour in the oil company or among logging concessionaires, has been extremely limited and is practically a new arena for most indigenous peoples. The 'development' has alienated indigenous communities and disturbed traditional hunting and food gathering activities, while introducing cash-governed and driven livelihoods.

The Sustainable Upland Livelihoods Improvement and Advocacy Support Project has been designed to assist indigenous communities in managing their own development intervention and claims over ancestral domains. As a community-based and participatory engagement between indigenous communities and AFRIM, the intervention led to the formal filing of necessary ancestral domain claims in the government, the crafting of their own ancestral domain development plans, and the implementation of integrated sustainable agroforestry, governance strengthening, institutional development, and land-based livelihoods.

A partnership between indigenous communities and the Alternative Forum for Research in Mindanao (AFRIM) has led to the formal filing of necessary ancestral domain claims in the government, the crafting of ancestral domain development plans, and the implementation of integrated sustainable agroforestry, governance strengthening, institutional development, and land-based livelihood projects.

Land policies and community-based natural resource management in Vietnam's uplands

Tran Duc Vien

Center for Agricultural Research and Ecological Studies (CARES)
Hanoi Agricultural University

Community-based forest management is just one of a number of measures for socializing protection tasks and developing forest resources rather than considering forest protection to be only a task for forest management forces, forestry workers or forest plantations.

Participation by ethnic minority communities in the highlands in managing and protecting certain forests has clearly produced forest ecosystems that are maintained and developed with a high degree of stability. This is because management is based on the principle of combining protection with the sustainable use of natural resources by local people. A sound and suitable policy environment, extending from the central to the local level, is an important factor in carrying out community-based forest management on a large scale.

In Vietnam, as in many other countries, a general model of community-based forest management is practiced. This general method has been applied for centuries by ethnic minority groups in remote areas of the country. It is not only an effective method for managing, conserving, and developing forest resources, but is also suited to local people's knowledge, their traditional customs and to ensuring their livelihoods. This paper presents some lessons learnt by researchers working with local people in the Ca River Basin, Central Vietnam.

Agroforestry as a strategy for community-based forest management program in the Philippines: Some impacts, challenges and recommendations

Romulo T. Aggangan¹ and Nelly S. Aggangan²

¹ Forestry and Environment Research Division, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), 4030 Los Baños, Laguna, Philippines.

E-mail: r.aggangan@pcarrd.dost.gov.ph or raggangan@yahoo.com,
Tel. # 63 49 536 0014 to 536 0020, Fax # 63 49 536 0016 or 536 0132

² Mycorrhiza Laboratory, National Institute for Molecular Biology and Biotechnology (BIOTECH), University of the Philippines Los Baños, 4031 College, Laguna, Philippines.

E-mail: nelly_aggangan@yahoo.com or nea@laguna.net

The Philippine Government has been using agroforestry as the main strategy and technology for the Community-based Forest Management (CBFM) program. As a national strategy, agroforestry enhances the sustainable development of the country's forest resources, while at the same time promoting people empowerment and social justice. It has therefore been an integral part of development of the uplands up to the present.

Local communities were granted tenurial stewardship rights to upland areas. This gave them peaceful occupation in exchange for responsible management that included protection and restoration of degraded forest sites. This shift in dealing with upland development favored the adoption of agroforestry as a strategy and technology to spearhead CBFM initiatives. In addition to providing tenurial instruments for the upland dwellers, the project provided technologies for forest production and agroforestry.

The importance of agroforestry is still reflected in the implementation of various programs that have followed, even though the CBFM program of the Department of Environment and Natural Resources started back in 1995.

Research and development in agroforestry is geared towards developing appropriate and sustainable technologies to provide food and alternative livelihoods for upland farmers, while addressing environmental problems related to soil erosion and forest destruction. Thus, the benefits of adopting agroforestry practices and technologies include securing food supply, reducing poverty, protecting upland environments and enhancing biodiversity. This paper will present some success stories and impacts of agroforestry practices in the Philippines. It will also present challenges and issues for wider adoption of agroforestry practices as well as provide research and development directions for agroforestry in the Philippines.

Certification as a mechanism to align short-term economic incentives and long-term biodiversity conservation incentives in highland and upland landscapes

Marcus Williamson

Highland Research and Development Institute, Thailand

The use of sustainable agricultural practices in highland landscapes has long-term benefits for farmers, including soil fertility conservation. The use of unsustainable practices frequently offers short-term rewards from industrial and retail buyers. Resource-poor farmers favor short-term rewards, and therefore sustainable practices are often not employed. Consequences of this include reduction of biodiversity and deforestation.

The use of food certification as a consumer subsidy for the employment of sustainable practices is an attractive strategy for aligning farmers' short-term and long-term incentives. In principle, it will remove the asymmetry that leads to the practice of unsustainable agriculture.

Organic certification is neither necessary nor sufficient for biodiversity conservation. This is the case because organic standards prohibit many high biodiversity methods of cultivation, including conventional agroforestry, but they allow agriculture with low biodiversity value, such as 'industrial organic'. Analysis shows that the inadequacy of the organic standard lies in the fact that it largely comprises prescriptions concerning chemical use and soil management, whereas biodiversity conservation requires the maintenance of habitats at many levels. A biodiversity-conserving standard must prescribe uses of farmland that maintains habitats at all levels.

The Highland Research and Development Institute (HRDI) has launched a project to create a certification system based on biodiversity-conserving farming systems. As part of this initiative, a market brand will be created for this certification standard in order to ensure consumer demand for certified produce. HRDI's project will be a model of market-friendly, mainstream biodiversity conservation.

**Farmers' adaptation to rural development policy under
Theun-Hinboun hydropower project: A case study of
Sobngouang village, Khamkeuth district,
Bolikhamxay province, Lao PDR**

**S. Channuan¹, S. Prabudhanitisarn², J. Thomas³, N. Badenoch⁴
and B. Ekasingh⁵**

¹ World Agroforestry Centre (ICRAF), Thailand.

² Faculty of Social Science, CMU, Thailand.

³ World Agroforestry Centre (ICRAF), Thailand.

⁴ IUCN, Vientiane, Lao PDR.

⁵ Faculty of Agriculture, CMU, Thailand.

The Theun-Hinboun Hydropower Project (THPC) was created in 1994 as a large joint-venture hydroelectric project between the Lao government and foreign investors. Its development activities have been carried out to improve the livelihoods of people and communities affected by the dam construction. This project has also applied upland management policies as the framework for implementing agricultural development activities in the area.

The research employed both quantitative and qualitative methods. Reviews of literature were compiled and secondary data was collected from various sources. The data was later analyzed and used to complement primary data obtained by means of questionnaire completed by 66 farmer households. The data was then qualitatively and quantitatively analyzed using descriptive statistics including numbers, percentage and means. The results were descriptively presented together with figures and tables.

Based on the study, it was found that government development policy and dam construction affected all farmer households, especially the two main policies of: Stabilization of shifting cultivation (aimed at reducing and stabilizing farming in the highlands); and Land and forest allocation policy. Both have led to positive and negative impacts. Prior to dam construction, 83.7 percent of land in Bon Phu (highland areas) was used to practice shifting upland rice cultivation and other crops, and 7.7 percent of land in Bon Piang (low land areas) was utilized for the same activities as well as for river bank gardens. At present, as a result of implementation of the government policy through activities and assistance from the hydropower project, it was observed that land use and cropping practices have been changed. That is, in the Bon Phu, only 47.5 percent of the area was used for shifting upland rice cultivation and for growing other crops. In total, 6.4 percent of land was used for permanent upland rice farming and agarwood agroforestry systems. Meanwhile, in the Bon Piang, farmers have increased their use of the land from 12.7 to 23.6 percent. An area of 2.2ha was also allocated to compensate for the reduction of river bank garden areas, i.e. from 2.5 to 0.6 percent of total agricultural land. In this area, the farmers changed from practicing shifting cultivation to permanent systems. They were supported to grow fruit trees mixed with field crops or permanent orchards, accounting for 9.8 percent of the area, and also to grow agarwood or

practice agroforestry. Some farmers have adapted the land use pattern by themselves so as to grow paddy rice in the Bon Homhuai (the valley area). Since starting in 2003, this land use pattern now covers 16 percent of the village's total agricultural area. At the same time, areas that used to be used for fishing by the village (10 wang and 7 kaeng) have disappeared after dam construction. The farmers' animal husbandry has also been affected as the village grazing areas in the natural forest were reduced from two large areas to just one limited area.

Resulting from these changes, the farmers have had to adjust their cropping systems, especially for upland rice. Farmers changed from the old upland rice cultivating system of slash and burn and rotating the cropping area with a fallow period of 5–12 years, to a permanent system with a fallow period of 3-5 years. Consequently, the average upland rice yield reduced from 1.4 to 0.7 ton/ha. Although the paddy rice systems in the Bon Homhuai tended to produce greater yields (on average of 1.9 ton/ha) these yields were not adequate for consumption throughout the year.

Community based rural development in mountainous areas: Experiences of an integrated programme in Northern Laos

Adrian Schuhbeck

Community Based Rural Development Programme, German Development Service,
PO Box 207, Oudomxay, Lao PDR,
PH/FAX: 856-81-211 934 adrian.schuhbeck@ded.de; dedoudx@laotel.com

Around 85% of the population in the Northern Provinces of Laos depend to a large extent or even entirely on the sustainable utilization of their natural resources for their livelihood. Most people grow upland rice in various types of shifting cultivation systems, use local timber for building materials and utilize Non-Timber Forest Products for food, clothes and medicines as well as many other purposes. However their traditional land use systems are getting more and more unsustainable due to a heavy population growth and conflicts with external land use demands. This in consequences has important implications for their still very traditional way of live.

The Community Based Rural Development Program of the German Development Service is supporting rural communities in 15 northern rural districts, which are classified as poor and vulnerable by the Lao Government as well as international organizations active in rural development in Laos. The aim is to come up with feasible and applied solutions to the multitude of problems remote communities face. The program works with a participatory approach to increase local knowledge and help communities to utilize the resources available to them in a more successful way. The poster presentation shows some of the successful approaches taken in upland agriculture and the development of viable market chains.

Session 3

Redefining the Niche of Tertiary Learning Institutions in Agroforestry and Natural Resource Education for Upland Development

Paper and Poster

Learning for managing multi-functional landscapes: an expanding niche for tertiary agroforestry and natural resources education?

Per G. Rudebjer

Scientist, Education and Capacity Development
Bioversity International, Rome, Italy
Email: p.rudebjer @cgiar.org

Agroforestry has been taught in tertiary education for three decades but countries in Southeast Asia have taken strikingly different routes. Universities in Thailand offer agroforestry as optional courses of a few credit hours in BSc and MSc programmes. In the Philippines, more than 30 institutions teach full BSc programmes, or majors in agroforestry. But regular agriculture and forestry programmes in the Philippines may still have little agroforestry content. These different views of agroforestry education reflect each country's agriculture, environmental and educational policies and job markets. Agroforestry research has evolved from a primarily technical study of combined tree, crop and animal systems, towards a multi-disciplinary field of research on integrated natural resources management (INRM). Today, agroforestry science covers a wide range of drivers and processes that influence landscapes and livelihoods: *inter alia*, environmental service payments, market chain analysis, participatory landscape analysis, multi-stakeholder negotiation, policy analysis, biodiversity assessment in agroecosystems, etc. The items on this list cannot be isolated from other natural resources disciplines, such as agriculture and forestry. This paper then reviews key regional trends in the forest and agriculture sectors. It discusses how these trends converge at the landscape level and how this in turn leads to an expansion of the domain of agroforestry. Using the Thai and the Philippine cases as examples, this paper points at three challenges for education: i) For universities and colleges in Thailand to teach new dimensions of agroforestry, albeit not labeled 'agroforestry', ii) For universities and colleges in the Philippines to revise existing agroforestry programmes to cover an expanded view of agroforestry; and iii) For non-agroforestry programmes in the Philippines to adopt dimensions of agroforestry and INRM in regular agriculture and forestry programmes. The Southeast Asia Network for Agroforestry Education (SEANAFE) has since 1999 focused on enhancing the quality and availability of agroforestry education. This work has largely focused on strengthening specific agroforestry courses and programmes. Has the time come for SEANAFE to also target general agriculture, forestry and environmental programmes, to have a broader impact on the capacity for managing multi-functional landscapes?

**Sustaining quality in agroforestry education:
The Don Mariano Marcos Memorial State University,
La Union, Philippines experience**

Orlando P. Almoite

Chancellor, DMMMSU, Bacnotan, La Union, Philippines.

Governments, donors, researchers, educators and NGOs have undertaken several collaborative activities to understand, develop and promote various agroforestry systems. Agroforestry is considered to contribute directly to food security, livelihood, and health and nutrition through improving land productivity and services. As a result, the number of educational institutions that provide agroforestry education and training increased rapidly during the 1980s and 1990s.

In general, curriculum development in higher education in the Philippines has traditionally been top-down. In practice, agroforestry is an applied activity carried out on farms and therefore requires a participatory approach. Curriculum development in agroforestry must also be participatory. The acceptance, effectiveness, and sustainability of agroforestry education and training will be enhanced if different stakeholders are involved in the curriculum development process. These are among the many issues and challenges that the Don Mariano Marcos Memorial State University (DMMMSU) Institute of Agroforestry and Watershed Management in La Union, Philippines has addressed, and is continuing to consider in ensuring the quality and sustainability of its Bachelor of Science in Agroforestry. Offering the B.S. Agroforestry course as a formal degree program at DMMMSU in 1976 was considered a first for the Philippines and the world.

This paper also discusses DMMMSU's three decades of experiences in agroforestry education with emphasis on its institutional assistance program (curriculum development for undergraduate and graduate levels) both in a local and international context.

Learning to change in education from a community-based research partnership: Competence building for undergraduate students in community action research

**Budsara Limmirankul, Phrek Gypmantasity
and Chorpaka Muangsuk**

Multiple Cropping Centre, Faculty of Agriculture, Chiang Mai University,
Chiang Mai 50200, Thailand

The increased integration of a globalized economy is having differing impacts on agriculture, livelihoods and resource use, particularly in the uplands of Northern Thailand. Changes in agriculture and resource use pose new challenges for universities to redefine their niche in agroforestry and natural resources education. This paper reviews examples of sustainable land use management and presents a learning model to guide capacity building for undergraduates in agroforestry and natural resources education.

The overall research-education integration focuses on partnerships between farming communities and universities to develop dynamic learning modules that will better build the competence of undergraduates. The development is based on conceptualization of a context-mechanism-outcome relationship: (1) Contextualization provides a basic understanding of the interrelation of various elements such as agriculture, livelihoods, resources conservation and utilization, economic incentives, social relations, and institutional intervention; (2) Social mechanisms are introduced to promote interactive learning by both workshop facilitators and farmer leaders, supported by analysis of various case studies; and (3) Outcomes include competence in community action research in agroforestry studies.

The learning module is a four-week training workshop for senior undergraduate students with a natural science and/or social science background. It aims to build the research capability of undergraduates in using a community action research approach to biodiversity conservation and utilization in agriculture and community forest management. The learning phases consist of: (1) Concept, principles, methods and tools; (2) Case studies practicum; (3) Reflection and synthesis; and (4) Oral presentation and case research writing.

This paper highlights learning to change in education, drawing on local resources and cases of best practice. It also addresses the dynamics and complexities of agriculture and resource use that impact on rural livelihoods. The paper suggests that agroforestry and natural resources education, which is interdisciplinary in nature, would be best delivered by participatory interactive short course training modules, therefore maximizing benefits from community-university partnerships.

Conservation curriculum in Thailand: Blending local culture and knowledge with modern science to enable school children to participate in forest management

Pakping Bruns

Environment Partnership Manager

Conservation curriculum for learning to protect and rehabilitate the forest is an education program designed to involve schools and school children in forest management. It is one step in preparing a community to establish community forestry. The program has realized the ideas of the King and the Queen of Thailand to support people living in forest-friendly ways and obtaining benefits from the forest. The education concept and context development is one of people participation and using forest, nature and trails as learning centers. This education policy is required to follow The National Education Law.

The curriculum design is based on a creative learning process, delivered in a positive way to integrate one subject to another through the process of thought. It could be that the main subject is integrated to local situations or problems, or it could be that the local curriculum is created to support the main subject. The program is connected to indigenous knowledge, beliefs, religion and culture; weaving the beliefs of the older generation into new generations. It is a way to explore the traditional thought, which contains the foundation for local knowledge, together with modern knowledge and scientific methods. The ideal is one of using thought to identify how to manage and benefit from the use of natural resources while respecting nature and sustainability and considering younger and future generations.

The curriculum design includes a teachers' handbook which shows how to connect the human, physical, mind and environment together in the abstract. It also deals with the philosophy of open world vision and bio-vision relating to being born, growing older, becoming ill and dying. This outlines the beliefs of northern Thai people, who believe in the solar as the center of life, and makes linkages between the Buddhist religion and scientific method. These are meaningful concepts for northern Thai lifestyle and provide order for daily life. The curriculum design is created to link abstract ideas which appear in occupations, agriculture, art, music and literacy. These interactions reflect the relationship between earth and livelihood, life to life, plants and diversity through to the sacred nature. The sacred spirits are reflected by, and related to, culture, traditional norms and cultural ceremonies. These concepts are present in the lesson design for subjects on social knowledge.

The curriculum attempts to share ideas and experiences with others participants. If the program is successful in achieving its goals then it could be developed not only in Southeast Asia, but elsewhere in the world.

The power of school-led multisectoral partnerships in agroforestry development and promotion in the Philippine uplands: Lessons and experiences

Leila D. Landicho and Rowena D. Cabahug

Researchers of the Institute of Agroforestry, University of the Philippines Los Baños, College, Laguna, Philippines

The role of educational institutions as the prime movers in the transfer of learning appropriate for agroforestry development, is indeed recognized, as such institutions shape the knowledge, skills and attitudes of individuals. The Ford Foundation-funded Agroforestry Support Program for Empowering Communities Towards Self-Reliance (ASPECTS) that was implemented by the University of the Philippines Los Baños Institute of Agroforestry from 1997-2000 has proven the role of educational institutions in enhancing agroforestry development and promotion.

ASPECTS built a grassroots-oriented extension model for empowering upland communities while strengthening the agroforestry education programs of collaborating schools. Its ultimate aim is to enable the empowered communities to establish and maintain their own farmer training center and agroforestry extension services. This would contribute to increased farm productivity and income, improved ecological stability, and effective and efficient extension service organization. The two-stage approach to agroforestry development and promotion employed capability-building programs for staff of the collaborating schools, farmers of the pilot communities, and the institutions represented in the multisectoral convergence. The programs included: Establishing and/or improving farmers' training facilities (i.e. community demonstration plots, nursery, training curriculum, and farmer-trainers); Improving schools' learning resources (i.e. library resources, laboratory/field facilities); Farm-based research; and Linkage building.

The school-led multisectoral partnership served as a catalyst and an instrument to promote synergy amongst local development organizations. The valuable lessons and experiences gained from the ASPECTS model demonstrate its viability and the potential for fully realizing a sustainable community-managed agroforestry extension services with the collaborating schools as the lead institution in the multisectoral convergence. This is demonstrated by: Institutionalization of grassroots-oriented extension programs in the collaborating schools and local development organizations; Operationalization of community-managed agroforestry extension services through farmer-to-farmer training activities in the three partner upland communities; and Institutionalization of the multisectoral partnership in the three pilot areas.

**Paving the way to a threefold partnership and triple bottom line for agroforestry education in the Philippines:
The experiences of the upland resource and development center of the Isabela State University**

Florence T. Acay, Ph.D.

Deputy Director
Upland Resource and Development Center
Isabela State University
Cabagan, Isabela, Philippines

The Upland Resource and Development Center (URDC) is a research and development arm under the Office of the President of the Isabela State University. In 2003, in its first year of administration, the Center implemented its first threefold partnership with the Philippine Agroforestry Education and Research Network (PAFERN) and the Local Government Unit (LGU) of San Pablo, Isabela. Through a series of *Lakbay Aral* (guided tours) and experiential and interactive on-farm learning processes, the project organized and institutionalized a Local Agroforestry Information, Education and Communication (IEC) Team comprising a group of farmers, LGU representatives and ISU faculty staff. The project served as social preparation (as the team was embraced as the key actors) for the URDC banner project. The three-year old *Integrated and Sustainable Upland On-Farm R&D (ISU R&D) Project* had the overall aim of demonstrating the economic viability and ecological soundness of certain upland technologies that can address rural farmers' concerns regarding food security and sustainability.

The ISU R&D Project, which started in 2004, is a threefold partnership with the Department of Agriculture-Bureau of Agricultural Research (DA-BAR) and the previously formed Local Agroforestry IEC Team, under the management of the LGU San Pablo. The team has been further strengthened and empowered through the project. High economic returns are expected in the long-term, especially following the fruit-bearing stage of mangoes and other food production enterprises. These will be accrued from agricultural crops, chicken and goats dispersed to farmers under the micro-lending scheme. Ecological returns are enhanced through the adoption of organic and conservation farming practices such as the use of guano, nutrient recycling through the processing of bio-organic fertilizers from crop residues and mud, and the construction of various soil and water conservation structures (SWCs) such as rockwalls and water impoundments/ponds. There are three case farmers being studied in this project.

**Agroforest / Tree Domestication Farming:
An 8 -Year Experience in Collaborative Forestry-
Agroforestry Education, Research, and Advocacy of
a State College in Central Philippines**

Rumila C. Bullecer,

Forestry Department, CVSCAFT Main Campus, Bilar, Bohol, Philippines

Helping save the remnant forest patches of the island of Bohol has been a real challenge and task of the Central Visayas State College of Agriculture, Forestry and Technology (CVSCAFT), the only state college in this province island with serious mandates on carrying out its part on the poverty reduction programs of the province as well as in environmental protection and development.

In 1998, CVSCAFT established a 2-hectare tree farm, planted to more than 40 indigenous and timber and fruit species in three parcels of land within the campus at the height of protected areas development programs of the Philippines. It started as a rainforestation-research project aimed at showcasing the domestication of indigenous timber species and intercropping potentials. The growth performance of the timbers has been monitored and the intercropping potentials of crops noted. In the early period, the taungya system was applied with the planting of corn, root crops, beans, peanuts in appropriate places. When the canopy started to close in some spots, other crops like chayote, cucumber and ginger were planted.

TODAY, after 8 years, most of the species are now at the pole stage and showed successful adaptation to an open environment. The tree and agroforest farms have become a learning site to the community, visitors and students that indeed forest timbers can be domesticated in farms and be grown with agro-nomic crops.

This demonstration farm project remains as a highly effective form of advocacy in biodiversity conservation and other NRM efforts in the province. The challenge is to include more forest food species like vegetable trees (e.g., *Gnetum gnemon*) in the domestication efforts to address the concern for food security in the forest

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