
The Rural Ecological Agriculture for Livelihood (REAL) Project for Kanchanaburi and Nakhon Si Thammarat Provinces

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Thailand farming communities have been using natural biodiversity found in and around their farms for many livelihood functions including food, income, medicine, home tools and materials, and cultural activities. Nowadays, the availability of bio-diversity in the farmland is becoming scarce and/or has completely disappeared in many parts of Thailand. The degradation of farmland bio-diversity stems from farming methods which negatively alter the physical habitat of various plant and animal species, expansion of urban boundaries into farm areas, and pesticides. As a result, some important species have disappeared or their populations have become drastically reduced forcing communities to look for other sources of income, buy foods which they normally had for free and purchase other essentials that they previously were able to collect on their own farmland. The Thai Education Foundation (TEF) has been funded by BRT to pilot the development of the “Rural Ecological Agriculture for Livelihood” (REAL) Project in Kanchanaburi and Nakhon Si Thammarat provinces. The REAL project aims to build capacity of schools and communities to understand the importance of their farmland biodiversity and develop local level plans to conserve species that are important for community livelihoods. Participatory Action Research (PAR) is embedded in the learning process with the intention to produce community habitat action plans and support by research, as well as locally developed curriculum by participating schools.



Conservation planning and local knowledge development related to farmland biodiversity

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At present, we are all aware that biodiversity in farmlands is under threat. To preserve and recover farmland biodiversity, the community needs to have a conservation and utilization plan. For effective planning, the community has to gather all local knowledge and at the same time they also need to find new knowledge. So it is necessary to build the community's capacity to be able to conduct simple experiments. A project has been initiated in Nan Province in Reung, Chaisathan and Kongkuay Sub-districts, Muang Nan District, and DuPong Sub-district, Santisook District. The project's goals for each Sub-district are (1) to prepare a habitat conservation and utilization plan related to farmland biodiversity and (2) to develop local knowledge related to farmland biodiversity through community researchers. In addition, the project is also targeted at (1) studying the progress of habitat conservation and utilization plans in previous work areas, and (2) establishing a network for scaling up conservation planning and local knowledge development. The work has been conducted since May 2007.

Undergraduate Research Competence Program in Farmland Biodiversity (URCP/FBD)

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The goal of the URCP is to give students opportunities to conduct original research with farming communities on challenging issues related to farmland biodiversity. The immediate objective is to train students in their third or fourth year of studies to have capacity to conduct independent research on FBD. Seven undergraduate students from Rajabhat Phiboon Songkhram and Prince of Songkra Universities, and one Laotian Master student in Women studies at Chiang Mai University were participants in a four-week training workshop from April 27 to May 23, 2007. The classroom session was extended for 10 days to provide students with principles and practices in community action research and in integrating biodiversity in agricultural and forest landscapes. Interactive learning approaches were used to motivate students' interests and improve their understanding. These included short presentations, group discussions, role play games, case studies, and farmer presentations on biodiversity and rural livelihoods. Two students took turns to evaluate content and training methods everyday to help improve the next lesson. Individual students conducted self-evaluation on levels of participation and learning motivation. Field trips to proposed research sites were arranged to familiarize students with community research techniques. Students individually formulated research proposals and conducted independent field research on seven topics in three selected ecosystems. Students gave seminars on their research findings with Power-Point presentations. The students' written reports were corrected through email during the term before final submission. Three main factors enhancing students' capacity were 1) group learning dynamics, 2) virtual teaching tools, and 3) an interactive learning environment.

Enhancing farmland biodiversity in traditional rice-based agricultural landscapes of Phayao Province

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Smallholder rice farmers of Northern Thailand have integrated agro-biodiversity into their production landscapes to enhance livelihood diversification through various means, depending on the suitability of physical and natural assets. This study explored biodiversity in agricultural landscapes of Phayao province using a community action research approach. The objective was to develop common understanding and to strengthen capacity of rice farmers to regenerate, improve, and maximize the benefits of biodiversity through collective action. A farmer motivation workshop was first organized to include representatives of Phayao's Tambon Community Rice Seed Production Groups to review ecosystem, species and genetic diversity in agricultural landscapes, and to identify and establish strategies for incorporating a biodiversity agenda into farmers' production plans and practices. Four rice ecosystems and farming practices were selected for farmer capacity building. These were 1) multiple cropping in irrigated lowlands, 2) integrated farming in rainfed lowlands, 3) organic rice in flood-prone rainfed lowlands, and 4) mosaic land use systems in the lowland-hillslope interface. The participatory learning and action approach was implemented with selected groups at different sites. Field surveillance on species diversity across ecosystems was carried out as a group activity. Non-marketable plant species, wild plants, and mushrooms in different habitats contributed to daily household food requirement throughout the year. Overflow of the Ing River provided significant fish species for food and for cash for farm households in flood-prone lowlands. The studies showed that enhancing biodiversity in agricultural landscapes would require new types of communication, cooperation and research approaches among multi-stakeholders to develop common understanding for agro-biodiversity management.

Collective action in agro-biodiversity management for sustainable rural livelihoods in freshwater wetlands: A case study at Sakon Nakhon Province

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Wetlands deliver a wide range of ecosystem services vital for human well-being and poverty reduction. The Lower Songkhram River Basin (SRB) in Northeast Thailand, where flooding is an integral part of the annual hydrological cycle and wet season landscape, provides life supporting systems for villagers of Nakhon Phanom and Sakon Nakhon Provinces. A case study was conducted at Ban Dong Sarn, Sakon Nakhon Province, where villagers have adapted livelihood diversification based on rice, fish and aquatic resources, forest resources and livestock. The objective was to enhance local competence in planning and management of agro-biodiversity resources in freshwater wetlands through collaborative learning and better information management. Key community leaders, farmers and school teachers were invited to participate in a planning workshop to identify a possible research agenda and to collaborate in research activities in relation to management of agro-biodiversity. Five distinct ecosystems which are closely linked to rural livelihoods were identified for community-based biodiversity management. These included: 1) Songkhram River and oxbow lake for aquatic resources conservation and utilization, 2) community forest land, 3) upper terraces which are traditionally used for rainy season rice cultivation, 4) flooded lowlands where only dry season rice is cultivated, fragmented with natural ponds which are community-managed for fishing enterprises. 5) Tung Phan Khan wetlands where half of the seasonally flooded forestland (*paa bung paa thaam*) had recently been converted to farmland for dry season rice cultivation. The linkages between social mechanisms and ecological diversity have shown promising results in collective management of agro-biodiversity in wetlands.

Gender knowledge in conservation and utilization of agro-biodiversity in forest and agricultural landscapes of Vientian Province, PDR Laos

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PDR Laos is an agrarian society with about 80 percent of its population engaged in farming. Biodiversity-rich natural resources contribute significantly to livelihood support systems. Forest and farmland ecosystems are of great importance for impoverished rural communities, especially for women who live in marginalized areas, for collecting plant genetic resources for food, medicine and rituals. Research on gender relations in agriculture reveals that there is gender division of labour in farming. The knowledge and use of plant species is gender-differentiated. Since women work in the kitchen, they are generally considered to be the gatekeepers of food flow in and out of households. Culinary traditions are thus closely related to women's knowledge on use and conservation of agro-biodiversity.

Key research questions are:

1. How do gender relations in rural Laos help enhance conservation and sustainable use of agro-biodiversity?
2. How does loss of agro-biodiversity as a consequence of environmental degradation in forests and farmlands impact on women?

Research objectives:

1. To identify habitats, distribution and abundance of plant biodiversity used by rural households
2. To determine the use and value of plant biodiversity, and its impact on food security and household livelihoods
3. To differentiate gender knowledge on use and conservation of plant biodiversity in forests and farmlands
4. From the farmers' perspective, to analyze the potential threats to sustainability of plant biodiversity in the studied areas.

Research area:

The research will be carried out in Ban Pia, Pone Houg district, Vientian, PDR Laos.

Local organizations and institutional linkages in agro-biodiversity management and conservation

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Many successful cases of community-based natural resources management and conservation have achieved conservation goals and development needs together. Among the driving forces are strong leadership of local groups, and their ability to negotiate and link with external agencies to maximize the benefits of institutional collaboration in resources management and conservation. This paper describes roles and functions of local organizations in managing and conserving biodiversity to benefit local communities in Ban Pa Sak Ngam, Tambon Luang Nue, Doi Saket district, Chiang Mai province, and investigates the relationships between local organizations and external agencies that lead to successful co-management of natural resources. Through interaction with the Royal Initiative's Huai Hong Khrai Development Learning Center (the Center), the community of Pa Sak Ngam has set up various social groups, such as the Forest Protection Group, Forest For Life Group, Youth Group, etc, to collectively regenerate and protect forest resources for sustainable use. The village committee which consisted of different age groups with strong intergenerational relations proved to be visionary, providing guidelines for integrating conservation and development. With strong support from the Center, many social innovations from the village were extended to other groups and villages within the Center's network. Through strong social relations within the community and with external agencies, collective achievements included water conservation through check dams, an effective forest fire control program, conversion of forest biomass into organic compost for agricultural use, an environmental studies camp for schools and the general public, and a community library.

From monoculture to polyculture of vegetable production systems: farmers' perspectives toward biodiversity services to sustainable livelihoods

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Vegetable farmers in peri-urban areas practicing monoculture systems are facing decreasing marginal returns due to price uncertainty, pest incidence and high input costs. Conversion to pesticide-free or organic management provides ecological and economical solutions only when biodiversity is integrated into the production system. Many attempts to commercialize organic monoculture vegetable systems fail because of their uniformity. This study aimed to determine, from the farmer's perspective, biodiversity services to farming households that had converted to pesticide-free vegetable polyculture systems. The conventional systems were used as benchmarks for comparison. The polyculture system was dynamic with 23 species planted over the seasons based on species adaptability. Each species was planted on small plots about 5-10 m² with different rotations. The system showed insignificant pest damage, and harbored both pests and natural enemies more than did conventional systems. With a small plot size for each species, uniform application of a mixture of chemical fertilizer and organic compost was much easier, and resulted in higher yield. With increasing use of the fertilizer and organic compost mixture, farmers indicated that the soil was easy to work, and more earthworms were found. Farmers spent more time on-farm to manage the bio-diverse system than they did for the conventional system. Farmers claimed that monthly income from a pesticide-free vegetable polyculture system was almost double that of a conventional system, with an average gross monthly income of Baht 70,000 from a 3 rai plot. The case study illustrates that enhancing agro-biodiversity practices with emphasis on polyculture of diverse species and on fertilizer management, a pesticide-free production system is ecologically and economically viable.

Sustainable use and management of wild mushroom biodiversity in a marginalized community of Northern Thailand

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The livelihoods of rural communities in marginalized uplands of Northern Thailand are closely linked to the ecological integrity of forest resources. Extraction of non-timber forest products (NFTPs) and unattended free-grazing of livestock are common utilizations of forest land. Many cases of unrestricted demand for a finite resource ultimately doom the resource through over-exploitation. Such social traps follow the “tragedy of the commons”. Community forest is one solution where common pooled resources are collectively managed through regulatory systems. A case study was conducted in Ban Pa Sak Ngam, Doi Saket district, Chiang Mai province, to investigate how farmers manage the biodiversity of wild mushrooms to supplement their needs. Local forest experts on wild mushrooms were approached to help explore habitats and identify edible wild mushrooms. Nine habitats distributed over four types of forest, dry dipterocarp, deciduous, dry evergreen, and moist hill evergreen forests, were located. Ten wild mushrooms, which are distributed differently over time from May to December in different habitats, provided food and incomes. During the season, individuals could earn from wild mushrooms between 300 and 500 Baht per day. Regulatory systems were imposed to protect forest from encroachment and over-exploitation. Local members and visitors coming for mushroom gathering were informed about rules and regulations of forest protection. Within the community, mushrooms were often given to neighbors as “gifts”, or exchanged for other food items. Mushroom trading occurred with outside buyers. This mushroom case study indicates that collective management of natural resources supplemented with regulatory systems could result in sustainable use of mushroom biodiversity.

Local knowledge on conservation and utilization of the wild plant species *Melientha suavis* Pierre in dry Dipterocarp dominated forest of Ban Pa Sak Ngam, Chiang Mai Province

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Culinary traditions and preferences required to provide edible and culturally acceptable food have a marked influence on the knowledge, selection, use and conservation of plant biodiversity (Howard, 2003). Plant species selection for food entails more than culinary knowledge and skill, it also relates to local ethnobotanical knowledge and skills required to maintain, domesticate and propagate wild plant species. This study explored local ecological knowledge of *Melientha suavis* Pierre or Pak Waan Pah with emphasis on species habitat, uses, and community conservation practices for sustainable use. The field study was conducted at Ban Pa Sak Ngam, Tambon Luang Nue, Doi Saket district, Chiang Mai province, where the community's livelihoods traditionally depended on forest resources. Key community leaders, village social and functional groups were approached to discuss research interests and objectives. Local experts on *Melientha* species were identified, and a woman's group was included for culinary knowledge. One edible *Melientha* species was identified in eleven habitats of dry Dipterocarp dominated forest of which three habitats, characterized by a gravel-soil mixture were most abundant. Women and men gathered wild species of *Melientha* during March-May when young leaves were about 15-20 cm long. During the season, each household on average consumed Pak Waan Pa three times per week. At least six common dishes were prepared from Pak Waan Pa. A few households gathered the species for local market, earning Baht 70-80 per day for 2 kg of young leaves. With a successful community habitat action plan, there was no motivation for farmers to domesticate the species.

Agro-biodiversity conservation and utilization in vegetable-based farming systems in peri-urban areas of Chiang Mai province

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Peri-urban farming systems have become important food sources for increasing urban populations. Biodiverse vegetable-based production systems are often thought to be economically unviable. However, farmers who have converted from chemically-based monocultures to pesticide-free vegetable-based polycultures have successfully managed crop diversity as an economic strategy. By combining polycultured fields and home gardens, farmers have created their own economic niche that provides stable daily incomes. This paper describes agro-biodiversity in production fields and home gardens of a peri-urban village specializing in commercial vegetable production. It specifically aims to determine the extent to which agro-biodiversity is being used and conserved by farming households. The case study was conducted at Ban Ping Noi, Saraphi district, Chiang Mai province, where 93 percent of 193 households engage in farming. The agro-biodiversity survey which was limited to vegetable species identified 78 species found in fields and home gardens, among which 44 were food crops and 34 were herbs and medicinal plants. Within food crop species, 26 were produced commercially, and 18 were home garden types. For commercial vegetables, farmers preferred fruit types to others. For home gardens, leafy vegetables were selected. Of those used for medicinal purposes, the majority of usable parts were leaves. Among 34 medicinal plant species, six were commonly found in all households for treatment of soar throat, muscular pain, bleeding stoppage, itching relief, and tonics. Consumption patterns of different age groups were determined. Four-cell analysis was used to differentiate species abundance and preference according to planted areas and households.

Enhancing biodiversity in irrigated rice-based farming systems

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Enhancing biodiversity is seen as a way to increase the effectiveness of sustainable farming practices by integrating biodiversity conservation into production landscapes. This paper explores cropping diversification in irrigated rice-based farming systems through focusing on integrating biodiversity-friendly management practices within local level conditions. The case study was conducted at Ban Dong Palan, Mae Taeng district, Chiang Mai province, where land use intensification has been made possible through irrigation and tube-well systems. Crop rotation, which was the main farming feature, included rice-soybean and rice-sweet corn in the irrigated lowlands. The maize-based systems were dominant in sandy loam areas where water was supplemented by tube-wells. In the sweet corn system, where crops are early maturing, farmers relay-planted egg plants or chili pepper when sweet corn was one month or 7-10 days after seeding, respectively. Cultural practices considered to enhance biodiversity included 1) pesticide-free and frog protection in rice farming resulting in varieties of edible aquatic vegetables, 2) soybean rotation with rice under minimum tillage provided less soil disturbance, 3) use of soybean thresh for mushroom production, and use of by-products such as compost added value to soybeans, 4) increased use of organic fertilizers in rice and vegetable crops, and 5) decreased use of herbicides in sweet corn and glutinous corn resulting in the emergence of edible Amaranth species. The case study shows that with proper cultural practice, biodiversity could be enhanced and could lead to sustainable farming intensification.

Women's knowledge on use and conservation of plant biodiversity in irrigated rice-based farming systems

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Culinary traditions are closely linked with biodiversity conservation. Since women's work in food preparation is usually based on locally available plant and animal resources, it is therefore considered essential for biodiversity conservation. The knowledge and skills of culinary traditions which are transmitted from mother to daughter have significant influences on selection, use and conservation of plant biodiversity. This paper explores women's knowledge on plant biodiversity that provides edible and culturally acceptable food, and the ways these food plants are conserved and used. A case study was conducted in collaboration with women members of family households in Dong Palan village, Mae Taeng district, Chiang Mai province. Year-round irrigation systems provided favorable growing conditions for food crops, cash crops and non-cash crop species. The case study showed that 58 plant species that were culinary traditional plants, among which 34 were cultivated mainly as home garden crops providing household requirements throughout the year, while 24 naturally occurring species were seasonal. The plant species were consumed as daily vegetables and prepared in a variety of ways in traditional Lanna Thai cuisine, of which mixed vegetable curry was the most common dish. The edible parts included newly opened leaves, expanding leaves, floral parts, fruits, and stems. This case study provided good evidence for the interrelationships between women's knowledge of culinary traditions and plant biodiversity. Home gardens have become places of *in situ* conservation of edible crop plants and herbs.

Socio-economic contributions of agro-biodiversity to the livelihoods of smallholder farmers

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Agricultural intensification has led to widespread decline in agro-biodiversity across different levels, from reducing numbers of crop species and varieties to decreasing natural enemy species. On the contrary, agro-biodiversity enhancing land use systems are multifunctional, producing a whole array of ecosystem services, besides biomass production, that have socio-economic impacts on livelihoods of smallholder farmers. This study was carried out to determine the socio-economic contributions of agro-biodiversity to the livelihoods of smallholder farmers in three sites with different land use systems in Chiang Mai province, Northern Thailand. The three sites included peri-urban, vegetable-based land use, irrigated lowland rice-based land use, and upland agro-forestry based land use systems. Participatory Rural Appraisal (PRA), key informant interviews, participant observations, and field surveys were used to understand the context of the three study sites. Field data obtained by student training were used for synthesizing case studies. The socio-economic impacts on food security, income stability, and social relations within households and in communities were emphasized. The three sites showed different complexities of agro-biodiversity. The highest was observed in the agro-forestry based system, which also showed the highest achievement in social relations where collective action was embedded. The biodiverse vegetable-based system produced stable and high farm income, but achievement was more individualistic. The irrigated rice-based system, with its limited crop choices, was vulnerable to price changes. It was generally observed that agro-biodiversity enhancing land use practices can increase food production and produce higher flows of ecosystem services, and can improve socio-cultural values, but the extent of these contributions has yet to be quantified.