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Relative Value of Agricultural Biodiversity on Diversified Farms: A Case Study in Donjaedee District, Suphanburi Province, Central Thailand

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Agricultural biodiversity ("agrobiodiversity") includes all components of biological diversity of relevance to food and agriculture. Agrobiodiversity provides many goods and services of environmental, economic, and social importance and makes important contributions to sustainable livelihoods. However, its importance has received little attention from farmers and government in Thailand. To encourage conservation, it is necessary to understand the local value of agrobiodiversity. This study was carried out during April to August 2007 to assess the value of agrobiodiversity on diversified farms in Donjaedee district, Suphanburi province, central Thailand. Data were collected through interviews and field observations with 10 farming families. The value of agrobiodiversity to farmers was estimated in terms of food, income, household materials, and medicinal use. The results showed that agrobiodiversity provides 33% of household food; two farming families earned 5,300 baht/year (151 US dollars/year) from aquatic animals; medicinal plants saved 1,000 baht/year/person (29 US dollars/year/person) in medical expenses; and several bamboo and wood products were made from local resources. Besides restoring agrobiodiversity, diversified farming also helps to improve livelihoods through cost reduction, supporting self-reliance, in comparison with monoculture farming. However, the current use of agrobiodiversity is lower than its potential because many farmers do not appreciate its value. Therefore, it is necessary to promote public and private support to raise awareness of the importance of agrobiodiversity, conservation, and sustainable use.

Key words: Agrobiodiversity, Value, Diversified Farm, Monoculture Farm

1. Introduction

Thailand is an agriculture-based country rich in agrobiodiversity as a result of its diverse farming systems, wide variation in microagroecological niches, and varied sociocultural settings. It has a national policy on biodiversity, and a committee for sustainable biodiversity conservation and use was formed in 1996 (Bunchai, 2007). In 1997, the committee formulated a five-year master plan for capacity building in sustainable biodiversity conservation in protected areas (FY 1998–2002), and subsequently focused on conserving biodiversity in forest areas (FY 2003–2007) (Office of Natural Resources and Environmental Policy and Planning, 2006). However, agrobiodiversity conservation was not considered as a main theme in the plans.

Nevertheless, agrobiodiversity conservation is reflected in national policy via the promotion of sustainable agriculture in the 9th National Economic and Social Development Plan (2002–2007). As a key organization supporting sustainable agriculture, the Ministry of Agriculture and Cooperatives, in cooperation with the Danish government, launched the SAFE (Sustainable Agriculture For Environment) project in 2003. The immediate objective was to enhance biodiversity and sustainable resource management through participatory ap-

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proaches for the development and use of sustainable agricultural systems. Through the project, 70 farmers' groups made biodiversity conservation plans (Kamp, 2006).

Agrobiodiversity is not only plant and site specific, it is also a feature of whole fields, farms, communities, and landscapes (Stocking *et al.,* 2003). It provides many goods and services of environmental, economic, and social importance and makes important contributions to sustainable livelihoods (Cromwell *et al.,* 2003). Therefore, understanding the local value of agrobiodiversity allows us to encourage farmers to pay more attention to sustainable conservation and the use of biodiversity on farms (Iamsupasit, 2005).

In this research I ascertained the value to farmers of agrobiodiversity on diversified farms in terms of food, income, household materials, and medicine. I also compared species richness and utility and costs of pesticide and chemical fertilizer for rice production between a diversified farm in Suphanburi province and a monoculture farm in Chai Nat province.

2. Agriculture in Suphanburi and Chai Nat Provinces

Suphanburi province, central Thailand, covers 534,000 ha. Farm holdings cover 493,000 ha, of which 21,058 ha is residential land, 250,000 ha is paddy fields, 123,786 ha is agronomic fields, 9,286 ha is aquaculture ponds, and 1,426 ha is horticultural fields (Office of Agricultural Economics, 2005). Donjaedee district is located to the north of Mueang Suphanburi, the capital district of the province. It covers 25,208 ha, or 4.7% of the province. Agricultural land covers about 24,856 ha, most of which is paddy fields, and the rest of which grows field crops, fruits, vegetables, and cut flowers (Suphanburi Agricultural Office, 2000). In the last two decades, agrobiodiversity in this district had been dramatically decreased because of the heavy use of pesticides for rice. However, the Ministry of Agriculture and Cooperatives introduced the New Theory farming system (mainly for water management and food security) to farmers in 1998. Consequently, biodiversity has been gradually restored owing to the replacement of agrochemicals with organic fertilizers and fermented plant extracts derived from fermentation of weeds, fruits, vegetables and EM (Effective Micro organisms).

Chai Nat province, neighboring Suphanburi, covers 246,000 ha. Most agricultural land is irrigated, growing rice, sugarcane, cassava, and maize. Tambon Suahok is a sub-district in the east of Mueang Chai Nat, the capital district of the province. It covers about 3,833 ha. Agricultural land covers 3,279 ha, most of which is paddy fields, and the rest of which grows fruits and vegetables (Chai Nat Agricultural Office, 2005). Because of agricultural commercialization and lack of land ownership, farmers apply loads of agrochemicals to maximize yields, thus reducing agrobiodiversity and posing health risks.

3. Value of Agrobiodiversity

Data were collected through a questionnaire and field observation in Donjaedee district.

3.1 Foods

Vegetable and fruits comprised the largest food intake (46%) in the last 12 months (Fig. 1). Agrobiodiversity supplied around 33% of daily consumption. Thus, if a meal costs 100 baht, a farmer can save about 33 baht. Food plants are considered as a major group of species for household consumption because they are available for year round and farmers eat almost 12 days per month (Fig. 2).

3.2 Household Materials

Bamboo and wood are used to make farming tools and household items. Eighty three percent of total products derived from agrobiodiversity are made from bamboo and seventeen percent are made from wood (Fig. 3). Furthermore, 75% of household materials made from bamboo and the rest from wood were used within the last 12 months (Fig. 4). Products made from bamboo include chicken cages, sticks to support mango branches, and mango collecting baskets, and one farmer built a wooden machine for grading jujube.

3.3 Income

Fifty percent of freshwater species and 40% of plants were sold for income within the last 12 months (Fig. 5). Two farmers earned around 5,300 baht from selling freshwater species and frogs caught on their land (Fig. 6). However, most farmers (80%) ignored agrobiodiversity as a source of extra income.

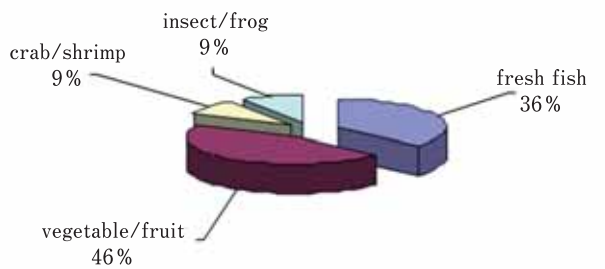

Fig. 1. Number of each species in farmland used for foods in the last 12 months Source: Survey May-July 2007

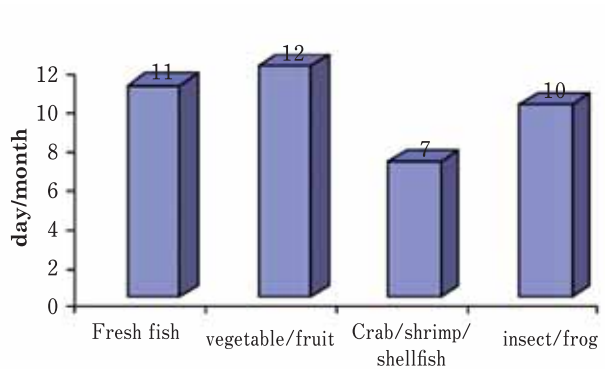

Fig. 2. Number of days/month that farmers ate each food within the last 12 months

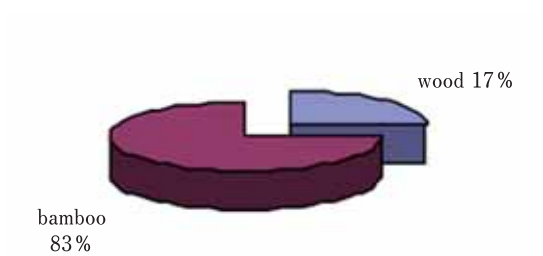

Fig. 3. Percentage of products made from Biodiversity materials

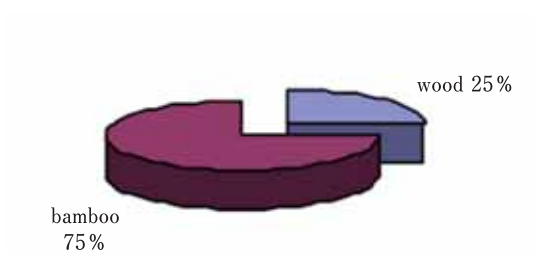

Fig. 4. Percentage of products used within the last 12 months

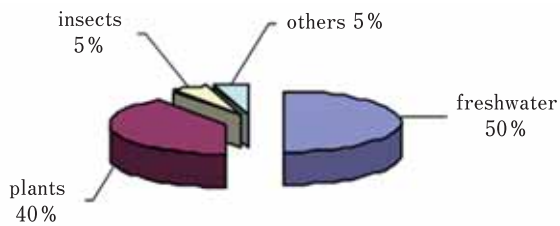

Fig. 5. Percentage of species that can be sold for making income within the last 12 months

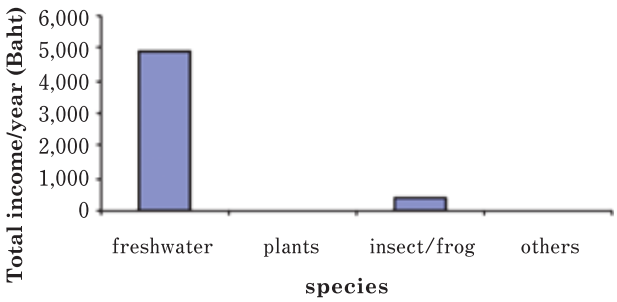

Fig. 6. Total income/year (baht) derived from Biodiversity selling within the last 12 months

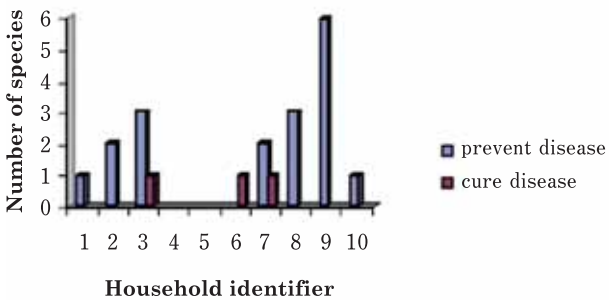

Fig. 7. Number of species of medicinal plants used within the last 12 months

3.4 Medicinal Use

The farmers use many medicinal plants as either curatives or daily preventives (Fig. 7). Three farmers used medicinal plants found on their land for first aid. Farmers used medicinal plants on average 33.3 times per year in preference to the 30-baht public health care program, saving 1000 baht per year per person.

3.5 Livelihood Improvement by Diversified Farming

The following questions on farmers' attitudes toward a diversified farm were asked. Can a diversified farm reduce production costs? Do you

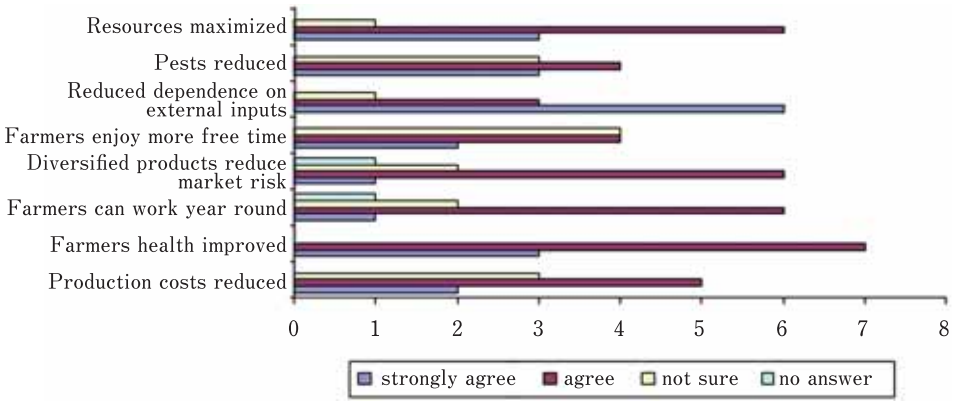

Fig. 8. Attitude towards diversified farm was assessed by asking the following questions: Q.1. Can a diversified farm reduce your production costs? Q.2. Do you have more time to enjoy social activities in your village? Q.3. Is your health improved? Q.4. Can family members work on the farm year round? Q.5. Do mixed crops reduce the risk from uncertain natural conditions and market movements? Q.6. Can a diversified farm reduce reliance on external input? Q.7 Do diseases and pests decrease? Q.8 Do mixed crops maximize the usage of farmland?

have more time to enjoy social activities in the village? Is your health improved? Can family members work on the farm year round? Do mixed crops reduce the risk from uncertain natural conditions and market movements? Can a diversified farm reduce reliance on external input? Do diseases and pests decrease? Do mixed crops maximize the usage of farmland? All farmers said that they are diversifying in order to maximize resources and reduce their dependence on external inputs, market forces, and climate variability (Fig. 8). Farmers agreed that after adopting diversified farming, they have become more self-reliant and their quality of life has been improved through better health, reduced marketing risk, and the return of useful wildlife such as frogs, dragonflies, earthworms, and ladybeetles.

4. Comparison of Species Richness and Costs of Rice Cultivation between a Diversified Farm in Suphanburi and a Monoculture Farm in Chai Nat

4.1 Species Richness

Species richness in every species group was richer on diversified farms than on monoculture farms (Fig. 9). Farmers attributed to the application of organic fertilizer and bio-extracts in place of agrochemicals. Monoculture farms, with their heavy application of agrochemicals, grew only rice.

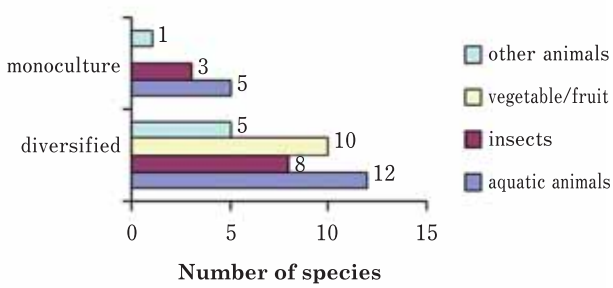

Fig. 9. Number of species found in two farming systems

4.2 Pesticide and Fertilizer Costs

The cost of pesticides was significantly higher on monoculture farms (3,125 baht/ha) than on diversified farms (1,250 baht/ha) (Fig. 10). Most farmers (90%) on diversified farms used bio-extracts and integrated pest management mainly for cost reduction, whereas monoculture farmers relied mostly on pesticides.

Most farmers (80%) on diversified farms spent less money on fertilizer than those on monoculture farms (Fig. 11). Farmers on diversified farms replaced chemical fertilizer with organic fertilizer made from agricultural wastes, at a cost of around 3,750 baht/ha, whereas farmers on monoculture farms spent around 10,000 baht/ha.

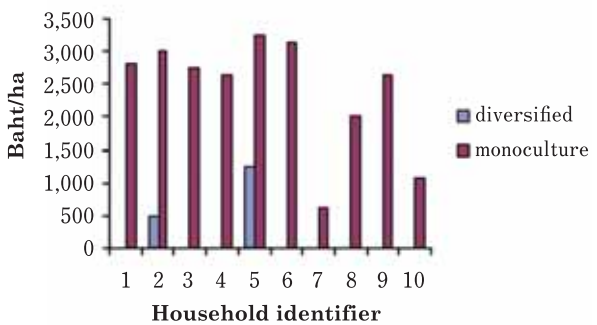

Fig. 10. Pesticide Costs

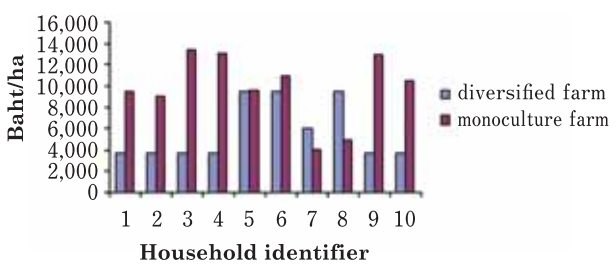

Fig. 11. Fertilizer Costs

5. Conclusion

Although biodiversity can bring economic well-being to local communities, many farmers do not appreciate or remain unaware of the value of agrobiodiversity to their livelihood. Farmers on diversified farms attempt to maximize the use of resources on their farms while improving productivity through environmentally friendly practices such as waste recycling and integrated pest management, which support sustainable agrobiodiversity use. In contrast, farmers on monoculture farms apply agrochemicals heavily to maximize their income, and remain unaware of the need to restore agrobiodiversity, which they consider to have low economic value. Incentives need to be established to stimulate the sustainable use of agrobiodiversity among small-scale farmers. Such incentives include:

- research support for agrobiodiversity conservation and use
- strengthening the capacity of local users, including indigenous groups and women, in agrobiodiversity management and development
- promoting techniques and technologies to enable communities to protect local agrobiodiversity, such as community seed banks
- establishing standards for liquid organic fertilizer and fermented plant extracts in promoting the use of alternatives to agrochemicals
- information distribution through community radio about problems that farmers face, research results, new successful technologies, and new seeds or animal breeds, for better use of agrobiodiversity
- support for maintaining and recognizing agrobiodiversity use by rewarding farmers who maintain crop and animal diversity, through newspaper articles, experts on the conservation of local breeds, and crop and animal fairs.

6. Recommendations

Farmers appreciate the value of agrobiodiversity when they start using it in sustainable way. Recognition of its value to sustainable livelihoods must be promoted through building capabilities in conservation planning based on the participation of self-supporting communities. Community conservation projects should be implemented across the country with the aim of developing capacity for sustainable conservation and use through participatory approaches. Capacity development requires building cooperation among concerned agencies at both the central and provincial levels; building community capabilities in conservation planning; and project management, evaluation, and reporting. Strengthening the ability to use agrobiodiversity requires policy and regulations for agrobiodiversity conservation and use in accordance with creating self-sufficiency and reducing poverty. Policies should promote the use of agrobiodiversity as natural capital (food security), social capital (farmer field schools), and human capital (training) for sustainable livelihoods.

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