

# The Importance of Farmland Biodiversity as 'Natural Capital' for National Development

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**Abstract:** The Danida funded Sustainable Agriculture for Environment Project in Thailand has been focusing on farmland biodiversity as an important component of sustainable agriculture and livelihood security for rural communities. Considering farmland biodiversity within the concept of "natural capital" helps to place greater understanding and importance on this aspect of the farm system. Cursory research and experiences from the Project suggest that the biodiversity found on intensively cultivated farmland in Thailand is very high and strategically important for household livelihood strategies. Yet very little research and documentation exists and, therefore, very little understanding of the importance of farmland biodiversity is shown by government agencies, including researchers. Farmland biodiversity is under considerable threat from many sources leading to critical reductions in the overall natural capital of Thailand's farmland. Urgent action is needed to improve the situation.



## Introduction

Biodiversity can be greatly enhanced by agriculture. On the other hand, agriculture can also deplete biodiversity. The fact that agricultural systems can both enhance and deplete biodiversity is very important if you are a farmer who depends on farmland biodiversity for achieving food security objectives. Unfortunately, the mechanisms and situations in which agricultural systems can radically impact biodiversity are not understood well enough by farmers, researchers and policy makers for the best management choices to be made. Considering farmland biodiversity as a form of natural capital could help to increase interest in farmland biodiversity and its important role in farming communities.

**CASE 1:** In 1980 in a small village in Amphur Tron, Uttaradit Province, a farmer applied *Furadan* to his rice field to control rice pests based on the recommendations of the agriculture extension department. It controlled the pests. It also killed the fish, shrimp and frogs in the rice field which the farmer depended on for supplying his entire extended household with food. And it also killed the fish, shrimp and frogs in all of the fields below his own rice field which his neighbors also depended on for their food. The farmer was so angry at the extension agent he asked him not to return to the village again. This is an example of farming systems depleting the biodiversity [natural capital] which was important for local food security strategies.

**CASE 2:** In 1993 in Tangail District in Bangladesh, an agriculture extension official visited a village in the late afternoon to find that the entire community was sitting around a rice field with joy in their eyes. They were "listening" to fish feeding on insects. Earlier the extension official had recommended that the farmers introduce fish fingerlings into their rice fields and stop using pesticides. These same farmers later harvest fish from their rice fields which had greater value than the rice they harvested. This is an example of farming systems enhancing biodiversity [natural capital] which resulted in increased local food security.

Together, these case studies illustrate two important points: 1) how agricultural system management can have an impact on biodiversity [natural capital]; and 2) how farmland biodiversity [natural capital] is directly related to food security. The second point is particularly important because it illustrates a fundamental difference between "western agriculture" and rural Asian agriculture.

Western agriculture tends to be a solely market-based function not much different than a factory producing any consumer product for the market. This is very different than rural Asian agriculture which is a complex mixture of food, income, material, household utilization and cultural functions.

It is interesting what the UN FAO has to say about natural capital: "Capital is a stock of real goods with the potential to produce a flow of benefits or utilities in the future (Hicks, 1939). Natural capital, then, is the stock of goods derived directly from nature that have the potential to contribute to the long-term economic productivity and welfare of societies. (Barbier, 1998) It includes raw materials such as timber, water and soil, as well as environmental services such as waste assimilation and watershed maintenance. In addition, natural capital provides utilities through the provision of aesthetic and recreational services (Leslie Lipper, UNFAO).

FAO goes on to describe, as many have before, the value of soil as natural capital and how 40% of the world's soils are already degraded, reducing the natural capital for which farmers depend on their livelihoods. But what the UNFAO does not mention is the biodiversity on farms which contributes to the long-term economic productivity of rural communities. And this biodiversity is much greater than "timber, water and soil". Farmland biodiversity provides important ecosystem services which provide indirect benefits to farmers as well as direct benefits such as food, income, materials, medicines, etc.. But because no value has been assigned to these systems they have been over-consumed and over-polluted, significantly reducing the natural capital found on farmland. Indeed, because so little value has been placed on these systems, they have received little attention, not only by researchers but particularly by mainstream agriculture support agencies. Effectively, farmland biodiversity is invisible to policymakers. How much capital is there in farmland biodiversity? Nobody knows.

This paper contends that the farm as a whole needs to be considered the "natural capital" of the farm, both for ecosystem services and as a system providing direct benefits to farmers. And there should be little doubt that the biodiversity of farms across Thailand (and the world!) is much more degraded than the current situation which exists for soils. But as will be repeated many times in this paper, the problem is that there is little data to support this statement. And this is a very dangerous biodiversity. First, very little was known

about where biodiversity existed on the farmland. Biodiversity is not homogeneous across the farm. Biodiversity levels vary significantly on the farm, with some areas being extremely high while other areas are very low. Typically, farm fields tend to be low in biodiversity due to the nature of farming practices being carried out in them. The figure below provides some idea of how the level of biodiversity might be compared across various ecosystems typically found on Thai farms, also comparing how it might differ in the wet and dry seasons.

Farmers, however, do recognize the importance of farmland biodiversity and the fact that it has been decreasing. It has been noted that small farmers in east Africa are beginning to replant land adjacent to fields with a number of tree and grass species in an effort to increase soil fertility, realizing that soil fertility (meaning soil capital!) is directly related to the organic material in it and the corresponding biodiversity. Groups that the SAFE Project has worked with in Thailand have protected the habitats for certain species and initiated enhancement activities.

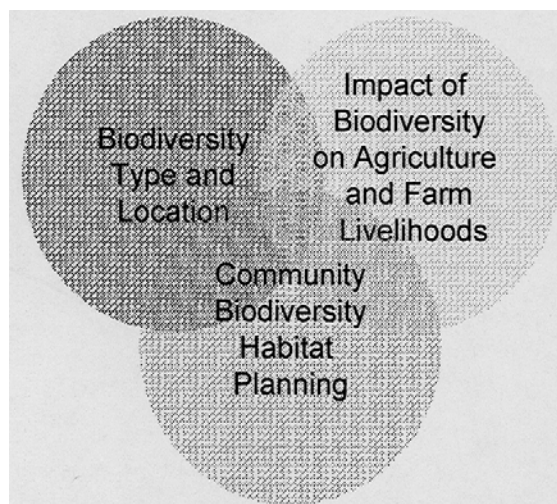
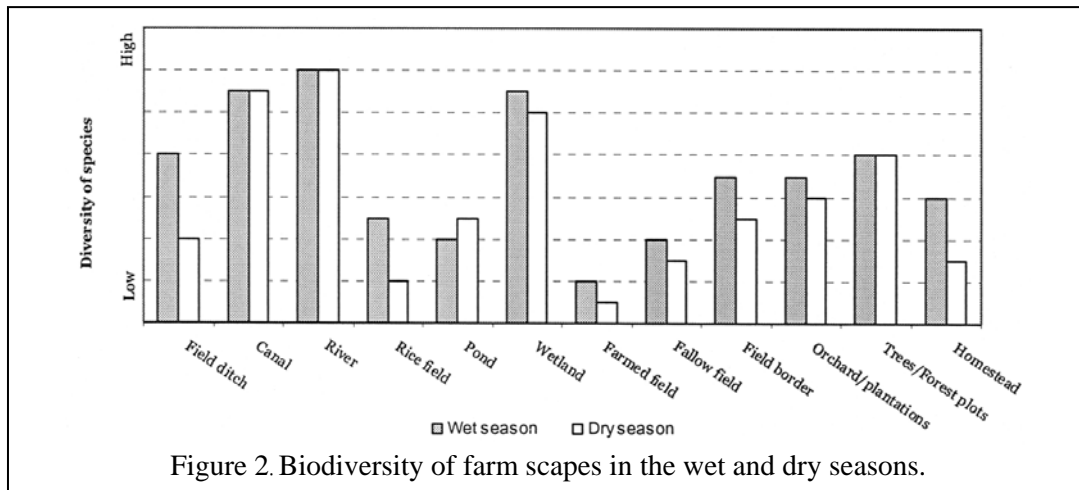


Figure 1. SAFE Project Schematic of Biodiversity Activities

The Danish funded Sustainable Agriculture for Environment (SAFE) Project addresses this issue through the framework of "sustainable agriculture". The project has had a specific emphasis on the issue of biodiversity as an important aspect of sustainable agriculture. The Project has approached the issue of biodiversity in farmland as per the diagram above (figure 1). The SAFE Project divides biodiversity related activities into three activity groups: i) research on biodiversity type and location; ii) research on the impact of biodiversity on agriculture and farm

livelihoods; and iii) working with communities to develop habitat action plans to conserve farmland biodiversity. These three activities are related. The first two are research-oriented while the later is action-based at the community level.

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The SAFE Project began focusing on these three activity areas as a result of the current situation regarding the low level of understanding and local-level action on biodiversity. First, very little was known about where biodiversity existed on the farmland. Biodiversity is not homogeneous across the farm. Biodiversity levels vary significantly on the farm, with some areas being extremely high while other areas are very low. Typically, farm fields tend to be low in biodiversity due to the nature of farming practices being carried out

Figure 2 above indicates [estimated] extreme variations in biodiversity levels across 12 potential ecosystems found on Thai farms. While these are only estimates, they provide considerable opportunities for speculation as to how biodiversity might differ within a farm, where the biodiversity exists and what types of biodiversity might exist in each ecosystem. Further, one can only speculate as to what the relationship is between the biodiversity in each of these ecosystems and how they relate to farming and



Figure 3. Farmland Biodiversity Functional Groups.

household livelihood strategies. Unfortunately, there does not seem to be enough research to substantiate or repudiate the data offered in this graph nor is the research growing at any appreciable speed.

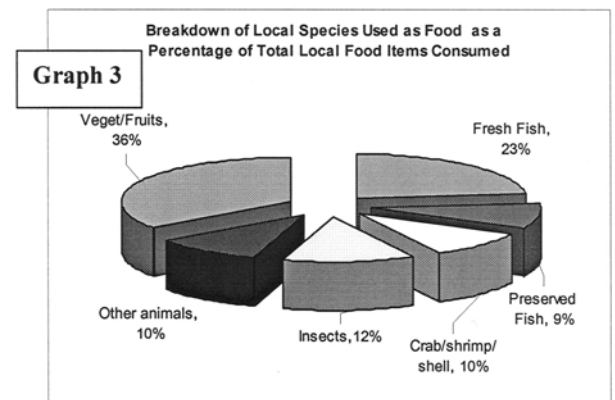
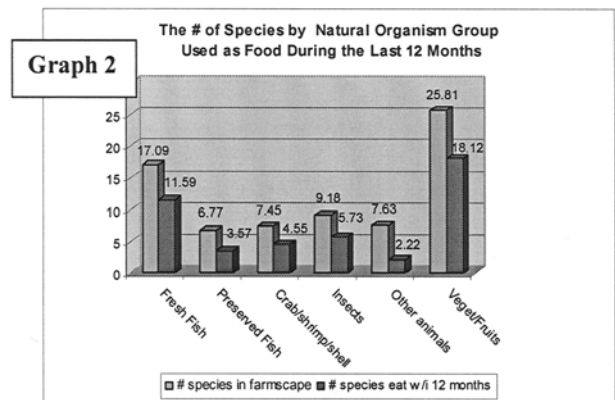
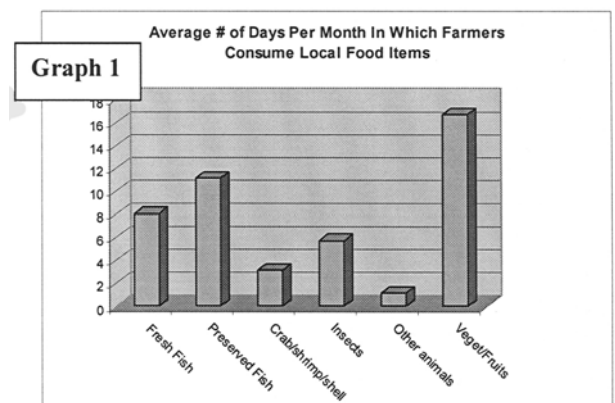
***The Relationship between Farmland Biodiversity and Natural Capital Methodology***

One of the most striking aspects of farmland biodiversity in rural Thailand is the fact that it is so heavily relied upon by farm families to meet their livelihood needs, biodiversity being one of the most important “natural capital” assets of the farm. The SAFE Project has classified the uses of biodiversity by Thai farmers into seven functional groups:

The seventh functional group includes biodiversity’s close and important relationship to agriculture, including but not limited to: pollination, soil building, and crop protection (natural predators, parasites and other protective organisms). This group can be best described at the “ecological services” provided to the farm. These seven functional groups are of critical importance to farmers, individually, and the country as a whole. How important is farmland biodiversity? Cursory studies undertaken by the SAFE Project provides some light on this.

In 2005, more than 150 farmers in eight regions of the countries were questioned regarding their use of biodiversity by means of PRA methods. There were considerable regional differences as well as differences between farmers, however, the results of these studies indicate a very considerable use and importance of biodiversity in their livelihood strategies, as per illustrated in the following graphs. Graph No. 1 illustrates how many days per month farmers consume local food items which grow wild on the farm, by group type. The groups are divided into six logical groups as follows: a) Fresh Fish; b) Preserved Fish; c) Crabs/Shimp/Shellfish; d) Insects; e) Other Animals; and f) Fruit/Vegetables. The significance

of the frequency of consumption of these food items cannot be overstated. Locally obtained food items are consumed most days with vegetables and fruit being consumed every other day (16 times per month). Totally, animal protein is consumed almost every day of the month, although the type of organisms consumed varies considerably. Based on this data it would appear that animals and plants/fruit found on the farm form a very significant and regular supply of food for a large percentage of farmers.



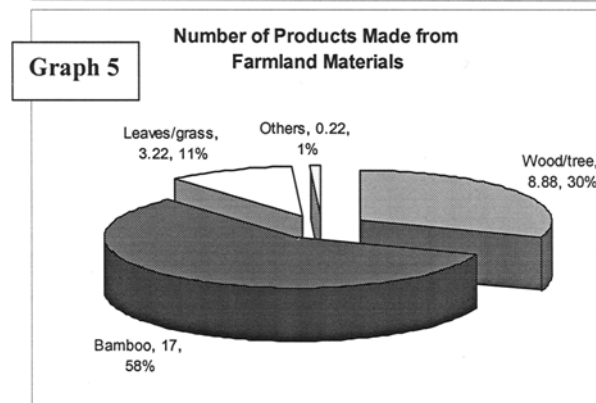
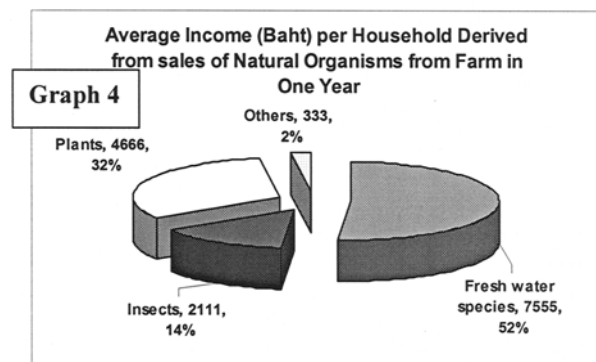
Graph No. 2 indicates the breakdown of food items consumed by group as a percentage of number of total food items consumed. This does not indicate quantity and frequency of consumption. For example, fresh fish species account for 23% of the species consumed, however, the quantity of fish consumed in the diet could be less than or more than 23%.

Graph No.3 shows the average number of species consumed by farmers for each of the three groups, and provides an indication of the amount of species which are consumed compared to total wild species known in the area. Of significance here is that approximately 62% of all the species familiar with farmers are used as food. In this case, out of 74 species, farmers report consuming 46 of them. It is unlikely (although not looked at in this study) that farmers eat a larger variety of wild species than domesticated species! Looking at this data combined, it appears that farmers consume on a daily basis an assortment of 46 species of animals and plant species found growing wild on their farms, with fish and vegetable/fruit making up the bulk of these species. The “value” of these species as food items, therefore, is considerable.

Graph No. 4 provides information on the income derived from farmland biodiversity, per household per year. Note that the total income is more than 14,000 Baht per year, with fresh water species (fish, shrimp, crab, etc.) making up 52% of the income obtained, with plants making up 32%. It is of interest the rather significant percentage of total income (14%) coming from the sale of insect species coming from the farmland. Again, the “value” of biodiversity in monetary terms is very considerable. Compared to the number of species consumed, however, the number of species which have the potential to be sold in the market is much more limited. Farmers only reported a total of 22 species which have market value, of which they reported only selling about 25% of that number. This would indicate a rather high market value for very few species. It would be interesting to see if

the value of these species is also contributing to a problem of over-harvesting and population depletion as well.

One particular group of “farmland biodiversity” which was also studied was medicinal herbs (Graph 4). Some farmers reported using more than 20 species of medicinal plants from their farms, with some locations reporting more than 50% of the farmers regularly using such local medicines. While most farmers used such medicines only a few times per month, some farmers reported using such herbal medicine every few days throughout the year. The real or perceived benefits from these medicines are undoubtedly considerable.



Finally, farmers were asked about materials which come from the farmland for use in the household. As can be seen from Graph 5, bamboo was the most useful material coming from the farm which farmers reported (probably under-reported!) using for making 17 different types of products. Wood/trees were the second most used materials from which an average of almost nine products were made.



In this cursory study, issues of environmental value, social value and ecological service benefits to the agriculture system from farmland biodiversity were not reviewed. The value from biodiversity for these three functions is likely to be substantial.

### ***How Much Do We Know?***

What we know about farmland biodiversity is probably very little indeed. It might best be gauged by asking questions about farmland biodiversity and ascertaining whether or not we readily know the answer. Questions should be asked concerning 1) where farmland biodiversity exists within typical farmland ecosystems in Thailand [spatially and temporally]; 2) how biodiversity is important to farm livelihoods [using the seven levels introduced in this paper as a starting point]; and 3) the impact of various farming practices on the wide range of biodiversity which exists [with a much greater understanding implied than simple “do not use pesticides” instructions to farmers as the sole strategy to protect biodiversity].

There have been many studies done to document at how rural communities use non-timber forest resources. Few have been done to look at farmland biodiversity resources. From the cursory investigations of the SAFE Project, it appears that the “natural capital” in farmland is probably a very significant portion of the overall value of the farm and that it is not limited to the crops being grown.

Given the importance of farmland biodiversity to total farmland capital, it is critical that farmland capital be maintained or enhanced. Much has been researched regarding increasing the productive capacity (capital) of soil because of the recognition that soil degradation is a major constraint to global food security. Based on this research many types of strategies have been developed to ensure the long term productivity of farmland soils. The statistics on soil degradation are alarming: 40% of the world’s agricultural land

experiences serious productivity impacts due to soil degradation and some regions of the world are experiencing up to 75% degradation of soils (FAO, Lipper). Biodiversity is much inclusive and more important than simply soil productivity since soil productivity is concerned primarily with healthy soil biodiversity and nutrient recycling. Farmland biodiversity, however, not only includes soil biodiversity but the biodiversity on the entire farm which has a direct relationship on soil biodiversity and many other livelihood functions.

The initial work done by the SAFE Project clearly provides strong justification for serious investigations and pro-active work on how to preserve farmland biodiversity as a major strategy to improve farmers’ livelihoods.

### ***The role of Farmers, Government Agencies and Researchers***

Farmers need to play the central role in conserving and enhancing the natural capital on their farms. There can be no substitute for farmer’s central role in this function. This means that farmers and their communities need to be active in conserving and enhancing farmland biodiversity. Farmers need to be supported by appropriate government policy and trained NGO and government staff, including researchers. Everyone needs to understand the importance of farmland biodiversity, the needs of practical research and support field-level activities to conserve and enhance it.

#### ***Farmers:***

Currently, farmers have much of the knowledge needed to make effective farmland biodiversity conservation plans. But they often lack a few critical pieces to making it work.

Ownership: Farmers need to feel ownership over the farmland biodiversity resources on their farms. Without ownership, and the benefits of such ownership, farmers will be less interested in conserving and enhancing these capital assets.

Responsibility: Farmers need to feel and understand that they are the ones accountable for farmland biodiversity resources. This is not the responsibility of the government or other agencies. It is their capital and they are responsible for its management. Losses or enhancement of this capital is their responsibility and they will be affected by the gains or losses in farmland biodiversity.

Influence Events: Farmers need to feel they can actually make a difference in the level of farmland biodiversity. Their farming practices and livelihood strategies directly impact on the level of farmland biodiversity. They can change the situation, both individually and as a community. They need to know that they can influence what happens on their farms and in the community themselves. They do not need to wait for outside assistance. They have the power.

Information Gathering and Research capabilities: While farmers understand much about the systems on their farms, they don't understand it all. They need to be able to gather information and implement their own studies in order to understand the ecological systems on their farms well enough to make sound management decisions. They have to be able to incorporate new information into existing information to come up with better understanding of systems and how various activities affect them.

*Government Agencies and NGOs:*

Think holistically: More than anything else, it is important that we begin to think more holistically about the farm rather than considering it a factor which produces a few products for the market. The Ministry of Agriculture and Cooperatives tends to be divided into individual topics. While this helps develop a deep understanding of these specialized areas (which is important!), it distorts their importance. To help this, each of these departments may need to develop specialists in farmland biodiversity so as to make the connection between their specialization and how it fits into the "holistic farm".

Develop Farmland Biodiversity Specialists: From above, specialists who understand farmland biodiversity should be placed in each MOAC department so that they can integrate the important specialized work of these departments with the reality of farmland biodiversity.

Understand and Support the Community's Role in Farmland Biodiversity: While outside agencies can certainly support community and

farmer efforts in conserving and enhancing farmland biodiversity, it is important that they understand that the communities themselves are ultimately responsible for this. Agencies need to play a supporting role. Such support might be initiating action plans, helping communities to understand the importance of farmland biodiversity, developing community leaders, and helping farmers do research and document farmland biodiversity issues.

Support Research: It is vitally important that we understand farmland biodiversity and its importance to livelihood security much better than we do today. Research in areas with a similar emphasis to that done by SAFE is needed, but on a much broader and more sophisticated scale. Of equal importance is social research which documents the importance of farmland biodiversity to farm livelihoods.

## Conclusion

There is an urgent need to call attention to the significance of farmland biodiversity so that it receives adequate support to ensure the highest possible contributions to rural livelihood security in Thailand, and elsewhere. There should also be recognition that highly productive agriculture need not mean low biodiversity. Conversely, an interest in achieving high, productive biodiversity on the farm should not be seen as a threat, constraint or challenge to also achieving highly productive agriculture systems. They can both be done at the same time. But not without fore thought. And they cannot both be achieved without a much deeper understanding of what biodiversity exists on the farmland now, where the biodiversity exists, how farming practices have an impact on it, and biodiversity's role in providing important inputs into livelihood strategies of rural farmers. ■