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Implications of Agriculture Transformation and Farmers' Mental Health after Adaptation to the Climate Change

*Yanyong Inmuong**

Department of Environmental Health Science, Faculty of Public Health, Khon Kaen University, Thailand.
**Correspondent author: yanyong@kku.ac.th*

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Abstract

Climate extremes particularly severe flood and drought heavily damage rural farmland and community livelihoods. Most farmers find difficulty in coping with those unusual climate impacts as well as long-term adaptation. This case study reflects a Thai rural farmer family who transformed their agriculture practice from cash crop to integrated organic farming, which could successfully sustain their livelihood and well-being. A farm-scale activity assessment using sustainable agriculture indicators showed a promising result. The farmers had higher mental health score when compared to general Thai citizen.

Keywords: agriculture transformation, climate change adaptation, farmer mental health

1. Introduction

Most Mekong rural farmers, their livelihoods are very much dependent on rain-fed agriculture, at present climate uncertainty posts high risk on their agricultural production and household well-being (Osbahr et al., 2008). Those farm-lands are even further under threatened not only the climate impact but also deteriorations of soil, water and biodiversity. In addition, the farmers have often encountered their product value fluctuating markedly due to the world market price particularly to those cash crop growers.

The adverse drought and flood heavily destroy Mekong cropland and thus much reduce yield, while many business-bound contracted farmers can-not produce the cash crop volume meeting to the company requirement as earlier agreed. A number of rural farmers then get much stress with more debt and their livelihood becomes stringent.

Climate adaptation now becomes another new challenge for many farmers while they need a long-term resilience by diversifying their livelihood and agriculture production system (Twomlow et al., 2008). The small-scale farm holders who are the

most vulnerable groups, they actually need to cope with seasonal shock and adapt to long-term impact of the climate change. The extents to which rural farmers and community are able to successfully respond to the climate change, this depends very much on their adaptive capacity.

It is well observed elsewhere that one strategy to adapt to the climate change impact is to reform the conventional farm-land to organic production system. This farm type is a form of sustainability agri-culture (Rigby and Caceres, 2001), while the system often comprises of crops and livestock, recycled farmyard manure for fertilization and applying biological control techniques for crop protection from pest invasion (Fließbach et al., 2007). Bryan et al. (2009) noted that an adaptation of the farmers is crucial as to safeguard family livelihood and for food security reason.

However, farmers' adaptation to the climate impact by changing their farming practice is not easy, while Grothmann and Patt (2005) found this needs to truely understand of climate risk perception and perceive adaptive capacity of individual farmers. They also found that the degree of such change is originated from socio-cognitive rather than socioeconomic drivers. Once when changed, many rural organic farmers find themselves are more relief from the climate uncertainty impact as well as secure for their long-term income (Seo, 2010). Organic agriculture practices aimed for diversifying plant and animal species, and biologically building soil-fertility these make the farmlands are more resilient to the climate change impact (UNCTAD/WTO, 2007).

Recently, observation has been made and found that some rural northeast Thailand farmers begin to change their agricultural practice from cash crop oriented to an integrated organic farming. This farm type has so far been viewed as the best sustainable option in contrast to the conventional while the costs of chemical uses and natural devastation are high (Graber et al., 1995). Prior transforming to the eco-agriculture system, the farmers actually need knowledge and practical skills on assessment and effective use of their own livelihood assets; natural, social, human, physical, and financial capitals. It also requires a policy support from local and regional governments, as well as exchang-ing and sharing resources among com-munity groups while minizing importing external resources with relatively high-costs (Muller, 2009). The organic farming model requires a better understanding on farmland management which combines key inter-related biophysical and social dimensions, the non-linear descriptors and determinants, which even conditioning individual and population health status (Graber et al., 1995; Xu et al., 2008).

Climate change impact actually affects individual physical, social, psychosocial and mental health (Few, 2007). Some specific investigation results showed an adoption of eco-farming scheme having a positive impact on farmers' mental health

(Hounsome, Edwards and Edwards-Jones, 2006), while those who practicing organic farm even have less depression and be much happier than the conventional farmers (Cross et al., 2008). However, there is still very limited number of studies on farmers' health and the climate change impact, even various farmer groups already turn themselves into the organic farming scheme (WHO, 2003; Michael, 2008).

Organic agriculture and health is a close connection, many occupational health risks, food, water and vector borne diseases are well related to agriculture practices (Hawkes and Ruel, 2006). Alternatively, the emerging new social and environmental determinants of health concept, this might help the one who wished to explore an interrelationship between human health and agriculture issues. There are some recent human health and ecosystem quantitative models being developed, for example of Koren and Crawford-Brown (2004), but this still cannot handle a more complex health and climate association scenario which interplays by multiple factors.

This case study aimed to explore a lesson learnt by a rural Thai family who successfully transformed their farming system from monoculture to integrated organic farming practice, and capable of handling a severe drought impact. Particular objectives were to examine a farm-level practice on; (i) organization of farm structure and its component function, (ii) plant and animal diversity interdependency attributable to sustainable agricultural goal, and (iii) mental health aspect of farmers.

2. Research methodology

The authors use mixed methods of semi-structured interview, walk-through survey, and an inventory farm sustainable assessment sheet (SAS). The interview information included detailed historical to present farming practices, while the farm survey was geared to account of plant and animal richness and species records. The invented SAS which was employed and modified a key concept of Zahm et al. (2006) who proposed essential components to be included for the assessment of farmland sustainability, these were biological diversity, organization of farm space, ecologically plants and animals and resource recycling management, and quality of life and supporting community. The scaling score, the author applied the qualitative ordinal method which was proposed by Andreoli, Rossi and Tellarini (1999) and Tellarini and Tellarini (2000). Inquiry on farmer's mental assessment, the author used the Thai Mental Health Indicator Version 2007 of Depart-ment of Mental Health, Ministry of Public Health, Thailand.

The 12-acre study site is located in Jaturapakpiman District, Roi-Et Province, nortehasst of Thailand, 550 km. from Bangkok. The farm owner is a married couple who are only the two workforce working in their farmland. This farmland now becomes one of the best practices of sustainable rural agriculture farmland model, where organizing regular training

services for interest farmers or even government officials come and learn on how to do and promote integrated organic farming.

3. Results and discussions

Past to present breif agriculture pratice revisited, the farm owner had been growing monoculture crops, cassava alter-nately with sugar cane for more than 20 years, while later found their soil fertility was much deteriorating. They often experienced unusaul seasonal drought, which much devastaged their farm yield sporadically, thus made the family being in a darkness situation with gradually hugh debt and even hardly to support their son and daughter to school. In 1997, the family then reconsiderd to change their agri-cultural practice to a rather new compli-cated system which not much familiar to them the integrated organic farming system. The family leaders started to adapt themselves against the climate risks by stoping those intensive cash crop planting while redirecting to sustainable agriculture instead by growing mixed vegetations and raising animals.

Key adaption strategy to the climate impact, in principle, they were growing mixed crops as reducing risks as well as increasing resilience by planting forest remnant within their farmland. They started to reform their land-use pattern by dividing their farmland into five plots; (1) 4 acre for reforestation aimed to restore nature and eventualy for agroforestry business, (2) 2.4 acre for building a water pond, aimed to handle a long-period of drought, for supplying waters to all farmland areas as well as rearing fishes and frogs, (3) 2.4 acre for paddy rice growing for family con-sumption, (4) 1.2 acre for growing mixed vegetables and flowers, and (5) 1.2 acre for planting mixed fruit trees. The family eventually achieved their farmland com-ponents and the assignment function of each plot as in Table 1.

Next, the farmers began to plant climate tolerant native standing trees; Yang (*Dipterocarous alatus*), black wood (*Dalbergia cochinchinensis*), black rosewood (*Afzelia*

Table 1. Land-use division and functional assignment for the plots.

Land-use type	Area (Acre)	%	Functions
Farm house infrastructures	0.8	6.67	Building family house, temporary accommodation for trainees, composting house, firewood, mushroom hut
Rice paddy	2.4	20.00	Growing native tricky rice species
Rain water pond	2.4	20.00	Storing waters with capacity of 28,500 cu.m., used for farmland irrigation, rearing fish and basket-net frog in the pond
Agroforest plot	4	33.33	Growing native standing trees, understory planting and natural grown of mixed various edible herbal plants, mushroom species. Red ant colonized on the tree canopy.
Vegetable and flower garden	1.2	10.00	Planting long-term market demand vegetables and flowers.
Mixed fruit trees	1.2	10.00	Planting various edible fruit trees as the farm fence, and on the edges of the water pond and rice paddock.

xylocarpa) and Burmese rosewood (*Pterocarpus indicus*). Further they made the rain catchment pond while rearing native fish species; catfish, snake fish and tilapia, as well as putting the basket inside the pond for raising native frog. They also changed their business strategy to business unusual model by prior exploring any products perpetually demanded by local markets rather than the world markets. Finally, they found the nich products; celery (*Apium graveolens*), yard long bean (*Vigna sinensis*), marigold (*Tagetes erecta*) and fragrance screwpine (*Pandanus amaryllifolius*). The first two were vegetables that used for local daily consumption and the last was flower for using in many Buddhist rituals. Up to present, they have grown those plants around the water pond edges, while cerely and martigold are deliveried to local markets daily.

With more than 10 years' adaptation to drought, the farmland has been colonized by diverse 107 plant species. These were standing and fruit trees, shrubes, climbers, vegetables and mushrooms with 31, 26, 28, 11 and 11 species, respectively. The agroforest plot was now dense with standing trees yielded a variety of herbal plants and mushroom varieties which became another major income of the family. Many red ants (*Oecophylla smaragdina*) colonizing at the tree canopies produced plenty of eggs for best selling with high local market demand (as a favorite dish) particularly during summer months. Many local customers were coming to buy vegetables, herbs, fruits, flowers, fishes and frogs on-farm. The family could thus earn approximately 700 US$ per month in contrast to 200 US$ per month formerly earned from the cash crop. Till now, the family experienced no severe risk of drought as well as the market price uncertainty.

The family learned that the water pond and the reforestation plot played a key role in reducing livelihood risks from climate impacts. The pond with submerged plants could reserve rainwater supplying year-round for family consumption, vegetables and fruit trees. The mixed forest replantation was able to conserve soil moisture content, and that thus made many natural herbal vegetation species fruitfully growing understory, as well as a variety of mushrooms. This reforest zone now drawed

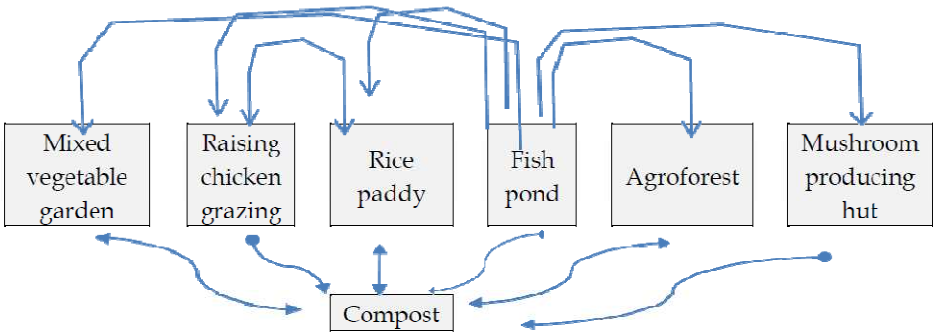

Figure 1. Farming units and inter-functional exchanging and recylcing resources.

many local residents to come and buy on-farm products, as well as learning of best practices on agroforestry.

For animal-based products, the family raised a number of native chicken species for local market demand, while the poultry waste mixed with leave litters and vegetable debris were used as organic composts. Controlling invasive pests, the family made use of biocide liquid which was extracted from mixed herbal leaves. The fruit and vegetable wastes were recycled by making biologically extracted liquid fertilizer for using within their farmland.

Resource recycling within the farmland, as prior designed, was now functioning well as seen in Figure 1. This was somewhat resembling the principle of permaculture while relying on ecological-based agri-culture system. All farm wastes were recycled as compost and the fish pond supplied waters to all farmland vegetations.

The sustainable agriculture assessment result showed this family farming practice could be able to meet the sustainable scale (Figure 2) while even some components; especially animal diversity and inter-relationship on exchanging between plants and animals have not yet been fulfilled. Mental health assessment score of farmers, a man and woman tested scores were 191 and 187 respectively. This ranges were classified as 'good' mental health status.

4. Recommendations

This case study reflected key essential information on a rural farm-scale adaptation to severe drought, which land-use reform was the predetermined planning strategy. Two structural components resilient to the climate impact, in which the farmers designed to be primarily functional units, were reforestation and fish pond. Building farmland refuged to conserve biodiversity, mimicking nature by planting native tree species could enhance in resilience to the climate change, as well as creating high-value particularly on non-timer value (Linder et al., 2002; Singh, 2008). The rain-water pond was functioned to conserve and supply waters to the farmland. This small reservoir was proved to reduce any climate impact while continuously supplied waters to farm plant and animals all year round.

The farmers collected all farm plant and animal wastes to make organic compost. This was aimed to secure that those plants had adequate nutrient enrichment as well as soil physical-chemical property amendment. Case study here confirmed that of Pacini et al. (2003) who documented that the organic agriculture was more conservative to bio-logical diversity and nutrient loss and they even proved that such this farm type was more profitable than other integrated and conventional farming system.

When this study quantified this farm-ing system with the sustainable agriculture assessment score, there were some com-ponents that the farmers' practice still could not meet the requirement; particularly, rotating crop and animal diversity. The rotating issue occurred mostly around the pond edge area where the farmers grew celery and screwpine at the same plot all

year-round. In many senses, this may not be a serious problem while the farmer thought these crops needed to grow close to water source and their compost was sufficient to maintain soil fertility. For animal diversity, apart from the chicken, the farmers thought that raising more kinds of animals might cost the family more as well as labor.

It was well observed that the farmers of farmlands adjacent to this farm were still suffered from severe drought impact. This then posed the local fact of climate adaptation process was still in question. Smit and Wandel (2006) found that the one was subjected for a change due to climate impact. This was very much depending on a course of response to individual impact perception from exposure, sensitivity and adaptive capacity. There might be some farmer groups that had no idea on how to deal with climate uncertainty effect. Mitchell and Tanner (2006) noted that a type of hands-on learning and practicing through the participatory appraisal technique may be able to fill that gap. However, many farmers were still concerned with immediate future while in this case Adger, Arnell and Tompkins (2005) documented earlier that feeding climatic information on possible next year scenario (rather than 50 years next) to farmer was another crucial determinant for helping the farmer to consider for a rational change. For the government sake, it was necessary to explore a real practice case of climate adaptation and translated that into a local meaning as this would help the farmers to get more understanding about risk, impact and adaptive options (Laukkonen et al., 2009).

During this study period, February-July 2010, there were reports from Thai hospitals that the farmers' mental disorder cases were increasing. For example, the Phichit Hospital, north of Thailand reported that there were patients of anxiety, de-pression, and intended to commit suicide, which were

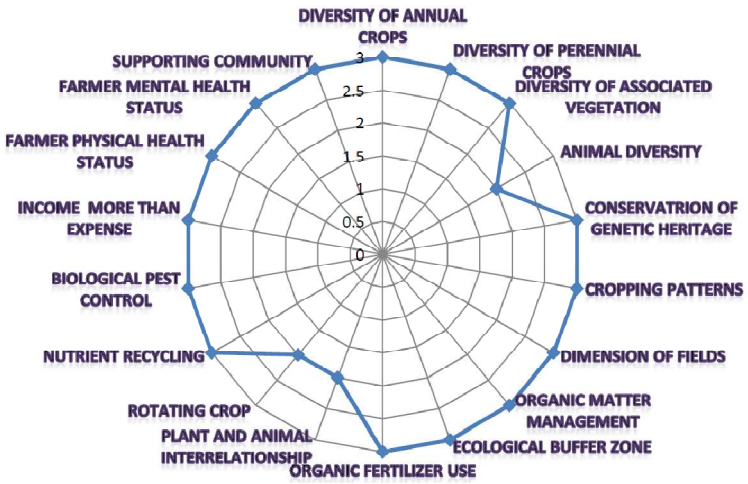

Figure 2. Assessment of agricultural farm-scale sustainability.

126, 278 and 26 cases, respectively. This figure has never happened before, while found all patients were farmers who were much worried about the severe drought impact on their farming business and family livelihood. The mental health investigation found by this study reflecting much contrary to those, the family couple was much happy with their lives; they enjoyed working in the farm for the benefits of income, recreation, exercise and even maintaining supports to community with organic farm practice exercises.

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