



Resilience of Rice-field and Mountain-based Native Beef Cattle Raising: A Case Study in Nakhon Panom Province, Thailand

THEERACHAI HAITOOK*

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

Email: theeha@kku.ac.th, pae-ait@hotmail.com

KRITAPON SOMMART

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

THEWIN VONGPRALUB

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

SURADEJ PHOLSEN

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

MONGKOL TAUON

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

WAREERAT PANNARAT

Faculty of Agriculture, Khon Kaen University, Khon Kaen, Thailand

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Abstract Native beef cattle raising by small-scale farmers in the rural areas of Thailand is vulnerable to ecological, institutional and technological changes. Decrease of vulnerability can be achieved by increasing resilience. The study of the resilience of rice field and mountain based native beef cattle raising in Nakhon Panom province, Thailand was therefore conducted as a case study to assess the resiliency level of the system. A focus-group workshop and survey were used in this study. Animals were raised in harvested rice-fields and shifted to a free-grazing area in a forest-mountain area over the wet season. The results indicated that the system was resilient. For this reason, it is felt that native-beef cattle raising in these two ecologies are sustainable. The resilience of the system can be manifested into eight elements: 1) good governance among rural communities and national parks in terms of policy and cooperation; 2) socio-economic enhancement and a sound and sustainable livelihood; 3) well integrated natural food resources in the forest with abundant crop residues and natural grasses in the rice field; 4) adaptation of land-use and the less significant need to support the basic infrastructure; 5) sound orientation and awareness of risks in the system (therefore, risk reduction stems from the integration between indigenous technical knowledge (ITK) and proper technology for herd management); 6) farmers' awareness of early warning signs of identified risks that alert them to prepare, protect and prevent the loss of animals; 7) well preparedness and undertaking of procedures established for animal protection such as diseases outbreak, heavy rain and supporting networks; and 8) in-place plans of action for the recovery of food resources and a herd management plan. Improvement needed, farmers focus on value adding within integration to husbandry practices and increasing an adaptation capacity for changes in the future.

Keywords mountain, native beef cattle, resilience, rice-field

INTRODUCTION

The native beef cattle production system in the northeast of Thailand, has played an important role in the sustainable livelihood at household and community levels over the past century. The system is a natural synergism of agriculture and the forest ecosystem. Rice cultivation is a major crop in the region and is well integrated in the raising of native beef. Accordingly, changes in socio-economics and the ecosystem have greatly affected production of native beef cattle. As a result, the production system has a resilience level which reflects sustainability (Adger, 2000). Adopting the tools to assess the level of resilience will assist the understanding of the system, further improving and promoting production in the region. The aim of the study is then to assess the existing production system in the realm of ecosystems. Nakhon Panom province has been selected as the target ecosystem where native beef cattle are raised under natural conditions.

METHODOLOGY

Focus group is composed of group's leaders and members of native beef cattle raising, mixed gender with age of 40-70 years old. Discussions were held to assess the resilience of rice-field and mountain-forest beef cattle raising systems in the Nakae district of Nakhon Panom province. Data and information were collected by application of the Participatory Rural Appraisal (PRA) tool, integrating the modification guidelines from the Coastal Community Resilience (CCR) developed by the US Indian Ocean Tsunami Warning System (US-IOTWS, 2007). The eight basic elements of CCR represent the desired conditions necessary to support resilience of the system. Each element contains benchmarks that can help determine the extent to which the element is addressed or operating to enhance resilience. The eight elements are: 1) governance, 2) society and economy, 3) natural resource management, 4) land use and infrastructure, 5) risk knowledge, 6) early warning system, 7) emergency response, and 8) recovery. Interviewees were asked to rate the level of resilience for each element presented in the questionnaire. A rating score of 1-5 was provided, where 1 = very low, 2 = low, 3 = moderate, 4 = high, and 5 = very high. A weighted average index (WAI) is then calculated for each element and illustrated in the spider diagram as shown in Fig.1.

RESULTS AND DISCUSSION

Characteristics of the ecosystem and overall resilience in the production system

The components of the studied ecosystem consist of a rice-field, which is adjacent to both a mountain and a settlement. The rice field serves as a habitat, with available feeding resources, such as straw, grass and drinking water in the dry season.

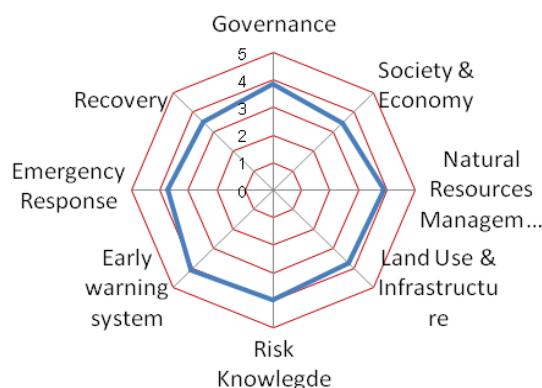


Fig. 1 The resilience diagram reflects resilience levels of native beef cattle raising in the rice-field and mountain forest-based system in Nakhon Panom province, Thailand (blue line)

Level of resilience: Low resilience (less than 3); resilience (equal to 3); and higher resilience (more than 3)

The mountain location provides natural grass, plant leaves, forest fruit, medicinal herbs, and drinking water. Resilience of the native beef cattle raising system in the component ecosystem is illustrated in Fig.1. Every element has a WAI score greater than three. It clearly indicates that the overall dimension of the production system is highly resilient. This reflects a system of sustainability over the past century. The details of each element are described in the following sections.

Governance of community-based, native beef cattle raising management

Good governance facilitates the consensus on development, responsibility, accountability and successfulness. The main focus is on institutional context, as the study is initiated formally via farming groups. The aim is to coordinate and strengthen the production system. The group has cooperated within and has been linked closely to policies from the Provincial Department of Livestock Development (DLD). The DLD supports technical services, including the development of in-place production plans and guidelines. Management and implementation of procedures were closely monitored by the committee. The group exhibited great cooperation with national parks regarding conservation and utilization of forest resources. Forest use purposes were for either native beef raising or sustainable household living. The community attempted to make significant contributions to protect, conserve and rehabilitate the forest ecosystem.

Community-based socio-economics of native beef cattle rising

Socio-economics reflects the production system's resilience and is well integrated to the livelihood of the community. Native beef cattle production is highly resilient in term of socio-economics and is adapted to both society and culture. The agricultural system of the study area, dominated with native beef cattle, rice cultivation and non-timber forest production, has provided a sustainable livelihood for more than a century. Regarding beef cattle farming today, it is said that "native beef cattle raises the farmer" rather than the cattle being raised by farmers. It is ranked second in importance after the paddy field. It provides security as the community's food source, either directly or indirectly; and a significant annual cash income. Additionally, cattle manure used as fertilizer to sustain soil fertility (Pholsen, 2005) is an equally important by-product. Normally, native beef cattle are ready to be sold when they return from the mountain-forest. One to two head of cattle per farmer are expected to be sold, at either a community event or outside market. Due to low production costs, farmers may decide not to sell their cattle if the price is too low or experience a high demand to sell, when prices are high. They normally decide to keep the herd though maintaining the herd size is not cost effective.

Community-based natural resources management for native beef cattle

Overall community-based forest resource management reflects the high resiliency for sustainability of the beef raising system. In the study area, farmers allow the native beef cattle to graze for six months in the mountain-forest during the rainy season, and six months in the post harvest rice-fields surrounding the village in the dry season. This is the normal practice for the typical combination of two ecosystems. As previously reported (Duanyai, 2009), the switching of the two ecosystems was due to insufficient feeding resources in the mountains and unavailable grazing land during rice cultivation. Natural resources in the ecosystem are considered to be most important for beef cattle raising. In general, natural resources are well protected and monitored by communities, local government and national parks. These communities demonstrate strong leadership in terms of conservation and forest resource management, with national parks and other stakeholders. The greatest reduction in beef cattle capacity is due to the prohibition of the use of rice fields surrounding the village and/or national parks. The number of cattle may be reduced to only one from ten in proportion. This reflects the importance of the rice-field ecosystem for the production system. The sensitivity of habitats, ecosystems and natural resources are protected and maintained to reduce risks from hazards such as forest fire, logging, hunting, collecting and other

encroachments. Communities are actively engaged in planning and implementing forest management activities, which are well integrated to their livelihoods.

Community-based land use and infrastructure for raising native beef cattle

Communities expressed a high resilience for the land use system. They have established measures that reduce the risks from forest fires and other hazards that negatively impact their livelihood and beef cattle raising in the long term. In general, communities have incorporated a better infrastructure in raising native beef cattle, such as creating a reservoir or canal to supply water to the rice fields. This serves agricultural activity in the dry season, enhances household income, and increases the security of beef cattle raising. Other infrastructures in the community are maintained such as a tap-water supply pipe, road accessibility, a broadcasting system, and effective mobile-phone communications. Therefore, marketing systems for beef cattle are well established between merchants and farmers regarding both the exchange of information and the sale of cattle. An equally important infrastructure is the servicing network of animal production from the DLD. The establishment of livestock volunteers in the community link villages for the purpose of disease prevention and other services.

Risk knowledge and mitigation measures on native beef cattle raising

Communities are aware of the risks and hazards that affect beef cattle raising, as seen in Table 1. The table shows all possible risk factors affecting the different levels of the native beef production system in the study's two combination ecosystems. The highest risk factors (scoring 7-10) show the unavailability of food resources in the mountains, rice straw in the rice fields, capital for first investment, and prohibition from national parks. Most risk factors are reduced via proper mitigation measures. This knowledge has been integrated into the community's livelihoods by means of both formally and informally exchanging information related to activities learned from the past. Other minor hazards are fever, injury, and lesions and/or wounds due to scratching in the forest. Disease outbreaks are a major hazard risk that can heavily affect the loss of cattle nationwide. However, mitigation measures provided regular vaccinations for cattle prior to placing them in mountain-forest areas. And, while forest fires in the dry season damage natural mountain grasses, fires in successive seasons may permanently damage natural grass, affecting native beef cattle raising in the rainy seasons as well. The measure to protect forest fires in the dry season has been taken with the cooperation of national parks., conducting preparedness to protect forest-fires in the dry season. In the rainy season, the hazard risk is at low level. Therefore, market price fluctuation is generally less affected, due to the existence of more marketing channels and seasonal summer events; such as marriages and festivals. Improving the quality of native beef meat by fattening is unfavorable among Thai farmers, as the return from the fattened beef is not significantly higher than from natural raising. It therefore leads to higher risk from increased investment.

Community-based early warning system for native beef raising

Effective warning mechanisms and understanding early warning messages helps to reduce the loss of beef cattle. Since farmers' awareness of hazards and information of risks, including their accessible capacity of cattle, provide a better herd management and advance preparedness in reducing the loss of animals. For enhancing a faster recovery of the production system, the community has established a communication network within the community, DLD, national parks, and beef cattle merchants. These networks facilitate a better flow of information for vulnerable beef cattle rising activities, such as any unidentified causes of death, diseases outbreaks, and government policies related to the DLD, agriculture and national parks, as well as market price and supply and demand within the local area. The community has various teams to monitor the native beef cattle activity in the mountain-forest area. Any cause for alarm will reach the cattle owner within a few hours so that they can respond swiftly.

Table 1 Risk factors affecting native beef cattle raising, from 1 (lowest) to 10 (highest)

Risk Factors	Rank of Impact	Description and Mitigation Measures
1. No community person for treatment of traditional disease	5	Number of farmers will be decreased about 50% as they are unsure of the survival of cattle in the forest-mountains due to lack of services for sick or injured cattle
2. Impact due to sudden change of season	1	No effect on native beef cattle, as they have a high capacity for adapting to the change of weather
3. Less food resources in the forest-mountain	8	Without food resources in the forest-mountain, it is of no use to raise native beef cattle in the forest-mountain
4. Onset of disease outbreak	4	Available volunteers service at the right time of disease outbreak
5. Risk from lack of skill in new farmers	2	Anyone can start raising 1-2 head of cattle without knowledge background, due to husbandry techniques based on indigenous technical knowledge, transferred from generation to generation
6. Fluctuation on price of beef cattle	2	Low production costs and low risks. Farmers can continue raising them until the price is better
7. Unavailability of native beef market	1	It can be sold at farm-gate by local merchants or thru the community's consumers mostly through local events and festivals.
8. Unavailability of concentrated feed	1	It is unnecessary for native beef cattle. It is needed for the skinny beef. Fattening is unnecessary
9. Unavailability of rice straw	10	It is the major feed resource. Farmers reserves rice-straw at home sufficiently throughout the dry season and partly in wet season
10. Unavailability of capital	10	Necessary for starting the business. But it is not considered as a risk
11. Risk from type of current breed of cattle	1	The native breed is the most suitable to the natural resources and environment. It has high tolerance to weather, insects, parasites and diseases, therefore adapting to the low quality of feed resources
12. Fattening program for native beef cattle	6	Fattening programs are a risk, considered unnecessary because prices are insignificant to normal raising beef cattle
13. Hybrid Brahman beef cattle.	4	Low adaptation capacity and low reproductive performance.
14. Prohibition from national parks	7	A high effect, especially in the rainy season, when insufficient rice straw may reduce the numbers of beef cattle around 70%
15. Unavailability of rice fields surrounding the community	9	Significantly affect the long term, as rice fields provide year round resources, which may be reduced around 90% of the current total
16. Accidents causing death.	< 1	Less effect to the number of cattle, as it is rarely happens
17. Onset of forest fire	9	Complete damage to the natural grass in the forest, for 1-2 years.
18. Unavailability of village livestock volunteers	3	Important in providing services, but has little effect to the herd size.
19. Unavailability of groups	5	For better coordination among members and other organizations
20. Unavailable DLD Officers	6	Lack of support for disease prevention and for emergency care

Mitigation, preparedness and emergency response for native beef cattle raising

Proper actions taken to reduce the loss of animals, enhance the resilience of the production system. Farmers are experienced in emergency response procedures to prevent the loss of animal life in the production system. Many emergency cases such as cattle fever, injury and wound require special treatment. In addition to the groups and beef cattle owners, village volunteers are key people in

emergency response to such cases, as well as right-time artificial insemination, and search and rescue of missing cattle. This includes accessibility to Provincial DLD for all emergency cases. In the area of risk management, and in the case of cattle evacuation or relocation; the shorter-route will be taken. That is to say, that the owner would decide to slaughter the animal rather than move it. Well preparedness and mitigation measures provide shelter from changing weather, and safeguard the welfare of the beef cattle; including guarding and monitoring the herd and population of cattle in forest-mountain areas.

Community-based native beef cattle raising recovery

The collapse of raising systems may be caused by various risk factors. The advance collaboration of related organizations would reduce risks from policy changing. However, this rarely takes place, due to the current policies of the DLD and national parks as well as community-based participation and co-management for forest protection, conservation, and utilization. Therefore, government policies are in place for damage compensation due to the loss of an animal from disasters, drought, flood, storm, and thunderstorms. The subsidies have been undertaken by local authorities, and provincial disaster prevention and mitigation through the Ministry of Interior. Thus, groups of native beef cattle raising farmers were formed to support the recovery function, especially in the loaning of feed resources and coordination support. Hence, social cohesion and strong leadership among groups have encouraged adaptation to change and facilitated a rapid product system recovery.

Challenge and sustainable development

The results of this study of the native beef raising system in a dual combination ecosystem reflect a synergism between man, native beef cattle and the ecosystems. It is agreed that ecosystems are the most vital component of the production system. A change in the ecosystem due to policies, technology, and damage caused by man-made or natural disasters, have a severe effect on animal husbandry. This has been clearly realized by stakeholders in the area. Native beef cattle adapt in nature with the abundance of natural resources in the ecosystem. Management adapts the Indigenous Technical Knowledge (ITK) integrated with new technology. This approach facilitates unsophisticated adoption and enhances the resilience of the production system. Sustainability of production systems is strengthened through concrete plans for conservation and rehabilitation of the two ecosystems, with a proper utilization of natural resources and proper land-use planning. Establishments of beef cattle raising group can promote self reliance. Strengthening the capacities is crucial via training courses, technical advisement, encouraging the development of planned, assistance in implementing, following-up, and evaluating the successfulness of the program.

CONCLUSION

Native beef cattle raising in the two ecosystems is a highly resilient system. Vulnerability of the production system is reduced from various mitigation measures undertaken to sustain the production system. It is recommended that the sustainability of native beef cattle can be enhanced via maintaining the ecosystems and increasing the capacity of stakeholders in conservation practice and proper utilization of natural resources and land-use planning.

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