

Building Resilience in Rural Asia: Combining Traditional and Modern Bio-Production Systems

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Summary: This study has confirmed the strategies to enhance resilience to climate and ecosystem changes and socio-economic fluctuations utilizing traditional bio-production systems in rural Vietnam, Indonesia, and Sri Lanka. In particular, the study presented intervention options with respect to both the traditional and modern bio-production systems of each country, and demonstrated the potential to strengthen resilience through the construction of mosaic systems that integrate traditional and modern systems.

Keywords: Climate and Ecosystem Changes, Adaptation, Resilience, Traditional Knowledge/Technology, Mosaic Systems

1. Introduction

This study was primarily carried out in rural regions in Vietnam, Indonesia, and Sri Lanka, with the main objective was to (1) quantitatively evaluate resilience with respect to climate and ecological changes and socio-economic vulnerability, (2) present countermeasure options to comprehensively enhance the resilience of rural regions utilizing the biodiversity, traditional knowledge and technologies, and finally (3) to establish bio-production systems that increases both the quantity and quality of agricultural production and constructs a sustainable growth strategy for rural communities.

The change of climate and ecological systems affects to the sectors, within the sector bio-production is particularly vulnerable due to the indirect impact of changes in the ecosystem and biodiversity. In addition, temperature fluctuations and water resource availability are directly impact on production [2]. For this reason, it is necessary to establish measures to enhance resilience to climate and ecological changes in the sector of bio-production. Moreover, with rapid increasing of population and urbanization in South and Southeast Asia region. A significant economic growth is essential to meet the rising food demand for future. Therefore, the improvement of bio-productivity in Asian agricultural regions and the enrichment of resilience to climate and ecological changes are essential to maintain food safety and security, and it has recognized a sustainable growth strategy.

The study proceeds as follow. Section 2 presents the adaptation of bio-production systems to climate and ecological changes. Section 3 on bio-production systems harmonized with biodiversity conservation. Section 4 on resilience enhancement measures utilizing traditional knowledge and technologies. Finally, the sections 5 conclude the summary of results are mainly addressed on sustainable bio-production systems in monsoon Asian region and also confirms the effectiveness of mosaic systems.

2. Adaptation of bio-production systems to climate and ecological changes

The University of Tokyo, Japan and Vietnam National University, Hanoi, was undertaken this research theme to analysis the impact of climate change on Asian agricultural productivity and agricultural production systems. The major objective of this research is (1) to evaluate the impact of climate change on rice production, and (2) to estimate the effects of climate change on agricultural productivity. For objective 1, we did future climate change projections for each country of the study using statistical downscaling method, Fourth Assessment Report (AR4) were based primarily on the special report on emissions scenarios (SRES) A2 and B2 scenarios of the Intergovernmental Panel on Climate Change (IPCC). By using these climate change projections, the study estimated the impact on the rice production, since rice crop is one of the principal crops in Asian region [3]. In the objective (2), the change in agricultural productivity was analyzed by estimating total factor productivity (TFP).

On the other hand, for analyzing the impact of climate change on the agricultural production system a commune (the smallest administrative unit) was selected on the periphery of Xuan Thuy National Park located in Nahm Dinh Province, Vietnam, at the estuary of the Red River basin on the South China Sea. In order to identify the impact of climate variability on the agricultural production system a variety of rice crop were selected in this study. Particularly, a field survey was conducted to identify the situation of natural disaster occurrence for the past 12 years (2000-2012); the changes in rice-based agricultural production; the cultivated production output in home gardens and pond; and also determined their key causal factors.

3. Bio-production systems harmonized with biodiversity conservation

The Research Institute for Humanity and Nature and Universitas Gadjah Mada was carried a research on bio-production systems harmonized with biodiversity conservation using the Gunung Kidul Regency of Indonesia as the primary case study; and a quantitative evaluation was conducted in which standards and indices were generated in order to make a quantitative comparison of resilience.

The Gunung Kidul Regency is a limestone plateau from which have water drains and a long dry season. As such, it is a region that has experienced chronic water shortages and is highly resilient to the impact of climate change. The area is moderately fertile and appropriate for commercial plants. Primarily, a survey was conducted in traditional bio-production systems to focus on home gardens, tegalan (mixed crop fields), and teak forests, etc., in a rural village in Gunung Kidul [5]. Later on, the same survey was implemented in modern bio-production systems on Kayu Putih (*Melaleuca leucadendron*), Sengon (*Albizia chinensis*), and other single-species plantations at locations in industrial forest plantations (Hutan Tanaman Industri, HTI) that were grown in a large scale of land primarily owned by the Sultan in the same region. Furthermore, in order to demonstrate the effectiveness of intervention options (detailed below), a survey was executed on a teak forestry co-operative in the same region affiliated with D Company, which had obtained forestry management certification (group certification) for small and low intensity forests from the internationally-active Forest Stewardship Council (FSC). In addition, the study was also examined the current effects of the certification on local residents.

4. Resilience enhancement measures utilizing traditional knowledge/technologies

The United Nations University and University of Peradeniya led the research on investigating options for enhancing resilience in the context of mutual home garden and irrigation systems in Vietnam, Indonesia, and Sri Lanka. Concerning home gardens, an interview survey was conducted by visiting individual households with a questionnaire developed jointly with local researchers. On the other hand, information collected from villagers by using semi-structured interviews based on the hypothesis that diversity of ecosystem services increases general and specific resilience roles. With respect to the home garden systems in the surveyed countries, data was collected and analyzed with a focus on causes of variation in the state and condition of diverse ecosystem services such as response choices.

For irrigation systems, discussions were held primarily with the relevant local water resource management organizations handle latest and older irrigation systems [6]. Thereafter, a study site for a modern irrigation system was selected in order to understand the water distribution process, opinions about operation and also to demonstrate a method of improving the current water distribution. Additionally, traditional irrigation systems with the potential to form an integrated water resources management system (mosaic system) were selected for this study in co-operation with the irrigation authorities [1].

5. Conclusion

The so-called traditional systems include agricultural production transform into modern systems are newly introduced in response to socio-economic changes [4]. This study demonstrated a combination of traditional and modern systems, which exploits on the merits of both and the implementation of some kind of intervention is necessary to further strengthen them, that is, the building of a mosaic system, has the potential to create a system more resilient to the changes above. Besides, such intervention may be effective as an adaptive measure to long-term climate and ecological changes. Traditional and modern systems are seen throughout rural communities in monsoon Asia. It may be possible to achieve greater resilience by combining these, implementing preferable intervention options, and constructing mosaic systems that integrate traditional and modern technologies and knowledge. The attainment of mosaic systems will achieve a more resilient society.

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