SUSTAINABILITY ANALYSIS OF LOCAL AND TRANSMIGRANT FARMING SYSTEMS IN TIDAL SWAMPLANDS : A PROPOSED STUDY IN SOUTH KALIMANTAN (BORNEO), INDONESIA[1]

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Abstract

Population pressure in Indonesia, especially in the inner islands of Java and Madura, has compelled the government to seek other areas to expand agricultural lands as well as to resettle people from these inner islands to the less-populated outer islands, such as Borneo. The tidal swamplands in Borneo offered one alternative to meet land requirements for both purposes. However, due to the unique characteristics of tidal the swamplands, farming systems in this ecosystem should be carried out appropriately, especially by the new settlers who are not familiar with the environments. It is becoming increasingly important in such environments to achieve sustainable agriculture which in turn will lead to sustainable development.

Keywords : *sustainable agriculture; tidal swampland; Indonesia*

1. Introduction

Population pressure in Indonesia, especially in the inner islands of Java, Madura, and Bali, has compelled the National government to seek other areas to expand agricultural lands, as well as to resettle people from the densely populated inner islands to the less-populated outer islands such as Borneo (Kalimantan). The tidal swamplands in the outer islands offer one alternative to meet land requirements for both agricultural expansion and transmigrant resettlement. However, due to the unique characteristics of these tidal swamplands, farming systems in the tidal ecosystems should be conducted appropriately, especially by the new settlers who are not familiar with tidal swampland environments. It is increasingly important in such environments to achieve ecologically sustainable agriculture, which in turn will lead to sustainable development. This paper describes the nature of population problems, the potential uses and problems of the tidal lands and the importance of agricultural sustainability to Indonesia as a background to study. The aims and objectives of the study, and the proposed methodology are also presented.

2. Background

Population problems

Indonesia, as is the case for many other less developed countries, is concerned about overpopulation. In fact, Indonesia is the fourth most populous country in the world behind China, India, and the United States. Indonesia's population problem is exacerbated by the uneven distribution of population over the Indonesian archipelago. More than 60 percent of the country's population resides in the major inner islands of Java, Madura, and Bali, which comprise less than seven percent of the total land area of Indonesia. The outer islands, of which the largest are Sumatra, Borneo, Sulawesi and Irian Jaya, are much less populated (Hardjono, 1977; World Bank, 1990).

As population increases, the demand for food and land also increases. In the late 1970s and in the 1980s, Indonesia imported around two million tonnes of rice, more than any other country in the world (Kartasubrata, 1987). In 2001, rice production in Indonesia decreased from 51.8 million tonnes to 50.8 million tonnes, while the country required 52.0

million tonnes for domestic consumption (Kompas, 2001) . Therefore, the need to increase agricultural production is pressing in term of food self sufficiency alone.

One of Indonesia's agricultural development programs is the extensification program, which seeks agricultural area expansion in the swamplands as well as in rain-fed upland and lowland areas. The main aim of the program is to target a constant increase in food production, especially for rice (the staple food of the people) (Fagi, 1996; Notohadiprawiro, 1986). This increased production effort is in line with the former national development programs which aimed to resettle landless farmers from the inner islands of Java, Madura, and Bali to the more sparsely populated outer islands through transmigration programs (Babcock, 1986; Balai Penelitian Tanaman Pangan, 1995b).

The Potential Uses, the Problems and the Characteristics of Tidal Swampland

Indonesia has a vast area of swampy land stretching along the coastal regions of the major large islands of Sumatra, Kalimantan (Borneo), Irian Jaya, and Sulawesi. Nedeco-Euroconsult (1984) estimated that there are 39.41 millions hectares of swampland in Indonesia comprising of 24.71 millions hectares of tidal swamplands and 14.70 millions hectares of non-tidal swamplands. It is also estimated that about 10 millions hectares of the total area could be opened and developed for agricultural purposes, and about 5.6 millions hectares are situated in the tidal swamplands (Nedeco-Euroconsult, 1984; Noorsyamsi and Sarwani, 1989).

In South Kalimantan alone, the natural resources are relatively abundant and still largely undeveloped (Noorsyamsi and Sarwani, 1989; Price and des Bouvrie, 1986). However, tidal swamplands are considered to be marginal and fragile land types (Conway, et al., 1983; Widjaja-Adhi and Karama, 1994) which need specific and careful ecosystem management to achieve a satisfactory and sustainable yield. There are about 800,000 ha of swamps here comprising 500,000 ha of non-tidal swamps, 200,000 ha of tidal swamps and 100,000 of ha rain-fed swamps. They lie in the six districts of Tapin, Banjar, Tanah Laut, Barito Kuala, Kotabaru, and Banjarmasin (Sadjeli, 1992). These areas presented an attractive option for government relocation of transmigrant people from the inner islands.

Most of the transmigrants were landless farmers. On their new lands, they faced a challenge to adapt to their changed situation, since in the inner islands, they used fully-irrigated systems with relatively fertile soil, while, in the outer islands, they must adapt to less fertile, non-irrigated, and acid soil. The outer islands however, were not unpopulated. People

indigenous to the area have been farming the tidal swamplands, using an agricultural system developed over centuries of occupation. These outer islands local indigenous farmers have adapted their farming systems to the hydrology and soil characteristics of the tidal swamplands. Their farming systems have tended to be viewed as sustainable (Kristanto and Simatupang, 1997; Noorsyamsi and Sarwani, 1989).

This view of their sustainability is similar to Hiraoka's view (1989) which emphasizes that the farming systems established by local people on floodplain locations suggest that the farmers have developed systems that can be sustained in the long-term. Jodha cited by (Gibbon and Jakobsson, 1999) states that local and indigenous farming systems were sustainable long before external factors such as chemical application were introduced to agricultural production practices. (Conway, 1987; Diegues, 1992; Vivian, 1992) suggest that some traditional farming systems have better implications for natural resource management and conservation than new intensive methods, even though many farmers may not realize that they are practicing ecologically sustainable farming systems.

The tidal swamplands have unique characteristics, which are influenced by water movement because of the sea tides. The water depths in the tidal swamplands are controlled by the tides, as well as by rainfall. Based on the prevailing water levels in fields, tidal swamplands can be classified into four groups i.e. types A, B, C, and D (Noorsyamsi, et al., 1984; Widjaja-Adhi and Karama, 1994; Widjaja-Adhi, et al., 1992).

A major environmental issue with tidal swamplands is the highly complex nature of the soil characteristics and the uncontrolled hydrology regime. Tidal swamplands are characterized by high soil acidity (low level of soil pH), and the availability of pyrite, Al^{3+} and Fe^{3+}, and quartz/sand is also high. In addition, tidal swamplands have deep organic layers which are more than 200 cm thick (Folkertsma, 1998). Consequently, these characteristics present many constraints to agriculture due to their low and ill-balanced nutrient status for plants (crops) requirements. The soils may also be toxic to plants. Furthermore, only a limited variety of crops can be grown in these areas. Selected crops should be tolerant of adverse soil conditions such as high salinity and acidity in order to produce an adequate yield.

Sustainable Agriculture

Especially during the last two decades, there has been a global growth interest in the environmental effects of agricultural practices, the capacity of soil resources and the long-term profitability of agriculture based on sustainability principles (de Sauza Filho, 1997;

Neher, 1992; Rahman, et al., 1999). This is due to the recognition of the damage that can be caused by unsustainable agriculture worldwide (Benbrook, 1990; de Sauza Filho, 1997).

The consequences of unsustainable agriculture can be very destructive and are illustrated by the widespread incidence of environmental pollution such as the accumulation of chemicals in soils and water, which leads to the loss of arable land and water quality, deforestation, desertification, and the damage to genetic resources. Unsustainable agriculture can also lead to a loss of biodiversity and damage to natural wildlife habitats (de Sauza Filho, 1997; Hutchinson, 1990; Senanayake, 1991; Tisdell, 1999b). There are several definitions of sustainable agriculture, but each tends to be applicable to site-specific environments.

Most definitions of ecological sustainability centre on maintaining agricultural productivity and farmers' profits while minimizing environmental impacts (Edwards, 1990; Rahman, et al., 1999). Lockeretz and Hauptile as cited by (Neher, 1992) proposed ten general features associated with the concept of sustainable agriculture. These are: selection of crop varieties and/or livestock which are suitable to farm's soil and climate, also they are resistance to pests and pathogens; livestock housed and grazed at low densities; on-farm resources; diversity of crop species either by rotations, intercropping, or relay cropping practices; applying deep-rooted crops in crop rotations; using cover crops and mulching; soil management; controlled inorganic pesticides application; using limited artificial pesticides; and restrict biocides application to minimum level.

Tisdell (1999a) considers three conditions as being important for ecologically sustainable agriculture as: "sustainable use of the biophysical environment; economic viability and, social acceptability". These conditions are similar to those proposed by (Neher, 1992) in which the three basic components of ecologically sustainable agriculture are identified - "plant and/or animal productivity, environmental quality and, socio-economic viability". Systems that meet these conditions often sustain good yields, have lower costs of inputs, demonstrate increased farm profits and reduce ecological problems (Edwards, 1990). Such models are associated with the possibility of practicing low external input agriculture (LEIA), which reduces the application of inorganic fertilizers, chemical pesticides, and so on (Tisdell, 1999a).

To date, research carried out in tidal ecosystems in Indonesia focuses on reclaimed land in such areas, and concentrates on increasing production output by intensive cropping or by pursuing the possibility of cultivation expansion (Balai Penelitian Tanaman Pangan, 1995a; Manwan, et al.; 1992, Supriyo, et al., 1991). However, the strategy of intensive crop cultivation and/or agricultural land expansion without considering the environmental aspects

may jeopardize ecologically sustainable development in the long-term, particularly sustainable agricultural production. This, in turn will, damage, not enhance Indonesia's long-term, prospects for self-sufficiency in food production. Indonesia food security is thus critically dependent on sustainable farming practice.

By contrasting and comparing the two systems of local and transmigrant farming practices considered in this study, it is possible to provide a sound basis on which to initiate a realistic improvement in the tidal swamp farming systems that is ecologically sustainable in the long run. Research findings are likely to be important for ecologically sustainable agricultural policy development purposes. The research results, while based in the tidal swamplands in South Borneo, will also be applicable to other areas across the country, and elsewhere in the world with similar environmental conditions.

3. Aim and objectives

The broad aim of the proposed study is to compare the farming systems of local and transmigrant farmers in South Borneo (South Kalimantan). Socio-economic aspects and environmental perspectives will be considered in the context of developing ecologically sustainable agricultural practices.

In order to achieve this broad aim, the project has the following objectives:

- To assess and empirically analyse the adaptive farming system carried out by local (indigenous) farmers in the area of study,
- To investigate and evaluate the farming practices undertaken by transmigrants on the same type of tidal swamplands as their indigenous counterparts,
- To examine and compare the economic worth of each group of farmers for each type of tidal swamplands being studied, as well as the farmers' incomes from external sources,
- To contrast and compare the two farming systems in terms of integrated ecologically sustainable agricultural practices

4. Proposed Methodology

Data collection

In order to fulfill the objectives of the study, a case study of each farming system in the selected tidal swamplands in South Kalimantan will be conducted. Data will be collected from sample units in the study area. The sample populations will consist of the socio-economically and culturally distinct local and transmigrant farmers who will be identified by stratified random sampling.

There will be extensive consultation with key informants such as community leaders, extension workers and, research scientists in the location of study. Qualitative and quantitative data will be collected and used to determine farm budgets, including the cost of production, opportunity cost of labour, economic returns and constraints to production, as well as farm operations, farming outputs, and biophysical, cultural and environmental attributes of the area. In addition, the respondents will be asked to provide demographic information. All data gathered will be confidential with respect to respondent identity.

Data analysis

Data will be processed and transformed for quantitative and/or qualitative analysis. In order to achieve the objectives mentioned earlier, descriptive and financial analysis will be employed to analyze and compare the farming practice of indigenous and transmigrant farmers.

Statistical analysis will use statistical methods such as multivariate analysis and cross-tabulation (Babbie, 1989; Hair, et al., 1995), while financial analysis will employ economic accounting methods such as cash flow, gross margins calculation and partial budgeting analysis (Makeham, 1976; Warren, 1982). In addition, an index of ecological sustainability will be developed to establish the extent to which sustainable practices have been applied by the farmers and to help to identify sustainable farming systems for use by farmers and policy makers (Babbie, 1989; Mohamed, et al., 1994; Norvell and Hammig, 1999; Taylor, et al., 1993; Youngs, et al., 1991).

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6. Appendix

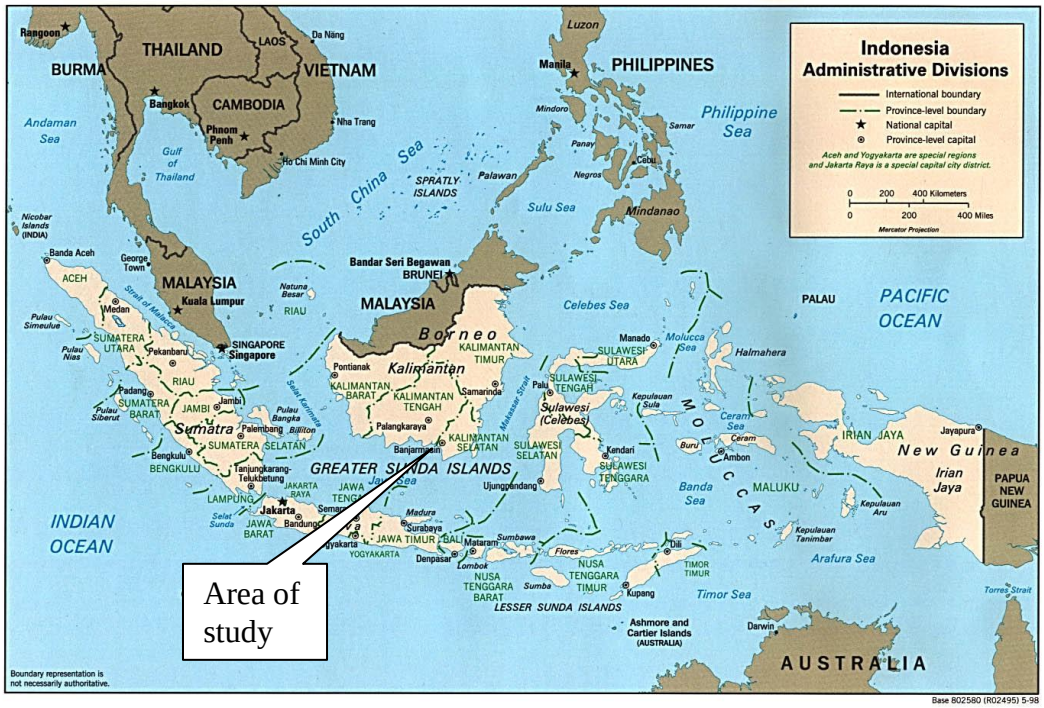

Figure 1. Map Showing Location of Study Area